

Maintenance Planning

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INTRODUCTION

Maintenance planning is an essential element of logistics. *It is the process of arranging in an orderly manner, all elements of maintenance support necessary to keep systems and equipment ready to perform assigned missions.* Though it is not a commodity in and of itself, it is, as should be obvious, heavily tied to the identification, selection, quantification, acquisition, testing, deployment and support of those elements of logistics that are commodities (i.e., support equipment, spare parts, facilities, packaging, tech data, etc.). In the long run, maintenance planning is probably one of the more significant factors influencing support costs. The ultimate outcome of maintenance planning is the identification of the actions and support resource requirements necessary to maintain the designed system and equipment in its prescribed state of operation. It considers the various maintenance functions and levels at which maintenance will be performed, including organic versus contract maintenance.

DESCRIPTION OF MAINTENANCE LEVELS

DODD 4151.18, *Maintenance of Maintenance Materiel*, defines the three levels of maintenance as follows:

Organizational Maintenance

Maintenance normally performed by an operating unit on a day-to-day basis in support of its own operations. The organizational-level maintenance mission is to maintain assigned equipment in a full mission-capable status while continually improving the process. Organizational-level maintenance can be grouped under categories of inspections, servicing, handling, and preventive maintenance.

Intermediate Maintenance

That materiel maintenance that is the responsibility of, and performed by, designated maintenance activities in support of using organizations. The intermediate-level maintenance mission is to enhance and sustain the combat readiness and mission capability of supported activities by providing quality and timely materiel support at the nearest location with the lowest practical resource expenditure. Intermediate-level maintenance includes limited repair of commodity-orientated components and end items; job shop, bay, and production line operations for special mission requirements; repair of printed circuit boards; software maintenance; and fabrication or manufacture of repair parts, assemblies, components, and jigs and fixtures, when approved by higher levels.

Depot Maintenance

That materiel maintenance requiring major overhaul or a complete rebuilding of parts, assemblies, subassemblies, and end items, including the manufacture of parts, modifications, testing, and reclamation as required. Depot maintenance serves to support lower categories of maintenance by

providing technical assistance and performing that maintenance beyond their responsibility. Depot maintenance provides stocks of serviceable equipment because it has available more extensive facilities for repair than are available in lower maintenance activities. Depot maintenance includes all aspects of software maintenance.

MAINTENANCE CONCEPT

The maintenance concept for a system is first described in the Operational Requirements document (ORD) prepared by the using command during the Concept Exploration phase of the acquisition cycle. This concept is gradually updated and refined through the succeeding acquisition phases as more information becomes available. ***The maintenance concept is a general statement that sets the broad parameters in which a support system must be designed. It is the initial description of maintenance requirements, considerations, and constraints for a proposed new system, equipment or a modification.***

The concept provides guidance for the formulation of maintenance design characteristics needed to achieve the optimum balance of operational effectiveness and life cycle cost. The maintenance concept is the framework upon which systems engineering and logistics planning are developed. Concepts developed and communicated prior to the procurement of new or modified systems, helps logisticians and engineers focus their efforts on operational and maintenance requirements.

MAINTENANCE PLAN

A maintenance plan evolves from the maintenance concept and shows maintenance requirements and resources needed. Specifically, a maintenance plan ***describes how the maintenance concept will be implemented, prescribes actions for each significant maintenance task that will be required for the system/ equipment during its life cycle***, explains technical requirements (where and how maintenance will be performed, incorporates detailed support concepts and resource requirements, lists the significant consumable items, and lists for each repairable item the supply, maintenance, and recoverability requirements/sources.

MAINTENANCE PLANNING AND THE ACQUISITION PROCESS

In the conceptual phase, the preliminary maintenance concept guides the design of a new system. Included are factors such as the maintenance environment (basing concept, climatic conditions expected, organizational structure, etc) and support factors (fully mission capability rate, sortie generation rate, etc.)

During the Program Definition and Risk Reduction (PDRR) phase, trade-off studies are performed to refine the maintenance concept. It influences and is influenced by the results of the ***repair level analysis (RLA)***. Though usually initiated in the PDRR phase, the RLA is not finalized until the Engineering and Manufacturing Development (EMD) phase when more detailed design information is available upon which to base the analysis. Typically contractor performed,

RLA is an in depth analysis of the potential reparability of system components. If determined to be economically feasible to repair, then the output will also recommend the level of maintenance that should perform that specific repair.

Though primarily an economic analysis, the final government decision as to by whom and where an item will be repaired will also be influenced by workload planning and force posturing.

Tradeoff studies will also consider such factors as repair location, types of maintenance tasks by organization, percent of base repair, percent of centralized repair, data collection sources, failure diagnostic techniques, support equipment requirement, technical data requirements and a myriad of other resource requirements that must be present to assure the attainment of organic repair capability.

During the EMD phase, the maintenance concept is converted into a maintenance plan. The factors which have undergone trade-offs are updated. Those factors which do not meet needs are analyzed to find if a design change or maintenance plan change is necessary. Special tests are conducted to determine the need for fixes or changes in the total fleet before all systems become affected. Logistics support systems are determined and refined through development test and evaluation and operational test and evaluation.

It is also quite common in the EMD phase for the chartering of a working group for site activation to plan the establishment of base level capabilities and a working group for depot activation to do the same for the depot maintenance capability. Both working groups are generally the responsibility of the program office to initiate. Each group serves as the corporate planner for their respective maintenance capability and the preparation of site or depot activation plans, as appropriate. Base level activation for large systems may also necessitate the establishment of a task force at the system deployment site(s). The task force is generally made up of operational and support personnel given the task of relocating to the deployment site up to two years before arrival to ensure all is ready to receive the system.

Another critical analysis most often performed on systems and equipment is ***Decision Tree Analysis (DTA)***. In DTA, ***the objective is to determine if it is more economically advantageous to contract repairs to industry or to establish an in-house (organic) repair capability.*** DTA is mainly concerned with depot repair. Though most often begun earlier in a program, it is once again most common to conclude this analysis during the EMD phase when a detailed design has been initially baselined.

However, the issue of contractor versus government repair is not the only determining factor. Since all our U.S. military services have a depot repair capability, we also evaluate the ability of these other services to perform depot repairs on our equipment. This analytical process is known as ***Depot Maintenance Interservicing (DMI)*** studies. Because another service may currently perform depot repair on the same identical or very similar item, the results of the DTA, if completed before the DMI study will be provisional. This means that if the DTA recommends

contracting the repair to industry, we wait for the DMI results, which may dictate that another service will perform the repairs.

If the DMI study concludes that no other service has the capability to perform the repairs and so depot repair responsibility rests with the acquiring service, then the results of the DTA would be followed. Based on the results and recommendations of the analysis, the DTA and the DMI studies, a depot source of repair (DSOR) assignment will be made. It should become clear at this point that the outcome of these varying analyses will dramatically affect the types, quantities, locations, etc., of the logistics resources needed.

It is during the production and deployment phase where we execute the site and depot activation plans prepared and coordinated in the previous phase. Once activation at the base and depot level occurs, we begin the nearly continuous process of maintenance plan evaluation to determine how well goals have been met and to refine the plan as needed.

Ongoing reductions in military force structure and weapon systems/equipment stocks are decreasing overall requirements for DoD maintenance support. The increased reliability of newer/modified systems and lower operational tempos of some users also contribute to decreasing depot maintenance support requirements. Because of their role in supporting contingency requirements, depot maintenance capabilities will continue to be vital in the national security environment. Consistent with the Defense Logistics Strategic Plan (DLSP), depot maintenance operations are focused on providing responsive capabilities to ensure readiness and sustainability for the Total Force in both peace and war.

DoD depot maintenance programs are structured and managed to provide reliable, flexible, cost-effective and timely depot maintenance support to the warfighters. Organic depot maintenance facilities are maintained to provide required capabilities essential to each Service's wartime mission. At the same time, depot maintenance managers are also attempting to create the leanest possible infrastructure consistent with providing essential support capabilities.

Each DoD Component owns and operates its own organic depot maintenance infrastructure. The bulk of the workload is associated with ships and aircraft, with each accounting for about 40 percent (by dollar value) of the total effort. The remaining 20 percent is for missile, combat vehicle, and other ground equipment system workloads. Organic depot maintenance facilities typically employ several thousand people and provide robust maintenance capabilities. The DoD Components are currently downsizing the organic (public sector) depot infrastructure, primarily by implementing base realignment and closure decisions (BRAC). When the BRAC process is completed in 2001, only 19 of the 38 major organic depots that existed in 1988 are expected to remain in operation as Government activities. Some of the closing organic depots may be transitioned into private sector entities and continue to operate as industrial facilities staffed by non-Federal Government employees. The total magnitude of depot maintenance expenditures, as well as the actual proportions of these expenditures that are consumed by the public depots versus the private sector, are not precisely measured. DoD currently accounts for about \$13 - \$14 billion annually for depot-level maintenance and repair work performed in both the public and

private sectors. From FY 1996 to FY 2001, the decline in total DoD funding is currently estimated to total about 6 percent (in constant dollars). This decline is principally due to continuing reductions in military force structure and implementation of BRAC recommendations, but also due in part to more efficient operations.

CORE DEPOT MAINTENANCE CAPABILITY

According to DoD *Policy for Maintaining Core Depot Maintenance Capability*, the Services will designate certain weapon systems, equipment, and components as mission essential for support of Joint Chiefs of Staff (JCS) approved scenarios. The Department ensures that there is DoD core depot maintenance capability to support these mission essential weapon systems.

Depot maintenance core is the capability maintained within organic Defense depots to meet readiness and sustainability requirements of the weapon systems that support the JCS contingency scenario(s). Core exists to minimize operational risks and to guarantee required readiness for these weapon systems. Core depot maintenance capabilities will comprise only the minimum facilities, equipment and skilled personnel necessary to ensure a ready and controlled source of required technical competence. Depot maintenance for the designated weapon systems will be the primary workloads assigned to DOD depots to support core depot maintenance capabilities.

The Military Services will use the DOD approved methodology to compute core depot maintenance requirements. However, it is not required that all weapon systems, equipment or components designated as mission essential be maintained in DOD depots. When the owning Service Secretary determines that sufficient assured source(s) of repair exist in the private sector to negate specific weapon system-related risk, that weapon system may be maintained by private industry. ***Major modifications and upgrades to increase the performance envelope of systems are not by definition part of depot maintenance CORE.*** The Government has traditionally obtained development and manufacture of kits for modifications and upgrades from the private sector.

Efficient depot maintenance support of new weapon systems is of utmost importance. However, the paradigm must change; we should no longer assume new weapon systems and equipment will transition to organic depot support. In many cases, there is neither a strong economic case nor risk control requirement for establishing organic depot maintenance support. The depot maintenance strategy is an important element of the acquisition process for new systems. It is clear that in this era of declining force structure, the strategy must be refined periodically throughout the entire acquisition cycle.

JOINT DEPOT MAINTENANCE AND INTERSERVICING

Depot maintenance is the highest level of DOD maintenance. Historically, depots have been able to repair material for 50 to 80 percent of acquisition cost. In some cases, weapon systems are old, out of production, and replacement parts are not available. In such cases, repair or

manufacture at the depots is the only option. Depot maintenance may be performed by commercial (contract) activities or by organic (government) activities. Often the Original Equipment Manufacturer (OEM) will be used as the commercial depot until a government depot is ready. Depot maintenance functions include:

1. Overhaul, repair, and modify weapon systems, end items, systems, and components.
2. Directly support organizational and intermediate maintenance activities.
3. Provide technical assistance to operational units in the field.

JOINT DEPOT MAINTENANCE (JDM) PROGRAM

The JDM Program is managed by the Services through a single organization under the Joint Logistics Commanders (JLC). This single organization includes people at many commands and facilities of the Services.

In 1974 the JLC formally organized the Depot Maintenance Interservicing (DMI) Program to maximize the efficiency of depot maintenance through interservicing, without hindering the operational readiness of the Services. Today the DMI Program is managed by the Joint Policy Coordinating Group on Depot Maintenance (JPCG-DM). The DMI Program mission has expanded to include joint Service business planning and joint Service sharing of information on technology and on environmental issues.

JDM Organization

The JPCG-DM is a JLC-chartered group of flag level officers responsible for depot maintenance. Collectively, members do the following:

1. Direct, plan, coordinate, control, and implement JDM program actions.
2. Ensure consistent emphases within, and interpretation of, established interservice policy.
3. Recommend appropriate policy changes to the JLC.

The Maintenance Interservice Support Management Officer (MISMO) within the logistics staff of each military Service carries out and directs JDM program actions for that Service. Key players in the execution of DMI are the Maintenance Interservice Support Officers (MISOs). MISOs are normally full time staff members assigned to Service commands and centers which require New systems, manage existing systems, and manage depot maintenance activities. MISOs coordinate, negotiate, and manage Depot Maintenance Interservice Support Agreements (DMISAs).

The Joint Depot Maintenance Analysis Group (JDMAG) located at Wright-Patterson AFB, Dayton, Ohio. is chartered by the JPCG-DM and staffed by full time members provided by each of the Services, JDMAG responsibilities include:

1. Conduct joint Service depot maintenance business planning.
2. Conduct depot source of repair (DSOR) analyses and recommend DSOR assignments.

3. Enhance exchange of depot related technology and environmental information.
4. Publish joint Service depot maintenance related documents.

Depot Maintenance Interservicing Program

The DMI program primarily deals with reviews of weapon systems to determine at which depot the system and its repairables should be supported. Joint DMI reviews are mandatory for all new weapon systems and equipment, end items, and associated repairables before depot maintenance responsibility is assigned or money is spent to start up a depot for a specific workload.

The DMI reviews are performed by the MISMOs and JDMAG using clearly defined procedures and an approved decision logic process.

Depot Source of Repair (DSOR) Decision Logic

The disciplined process used to make DSOR decisions starts with Service projections of depot requirements. This process accommodates four methods of assignment:

Directed Contract. Depot maintenance workloads which have been directed to be supported by contractors.

Service Workload Competition. Depot maintenance workloads which will be awarded through a competition. Open to private (commercial) as well as public (organic) sources.

Two methods are used to conduct the DMI review for all other depot workloads. These two methods require unanimous Service approval to assign the DSOR. They are:

MISMO Review. If the DSOR assignment is obvious from the nature of the workload and specific potential depot sources, the MISMO of the acquiring Service may conduct the review and recommend a DSOR assignment.

JDMAG DMI Study. For all other depot workloads, the MISMO of the acquiring Service submits the item to JDMAG for a DMI study. JDMAG conducts the study and recommends a DSOR assignment. Frequently the result of the DSOR decision is to interservice the workload, that is, to have one Service provide depot support for another Service's workload. When interservicing results, the Services have options for implementing.

Because depot facilities often have industrial and manufacturing capabilities with wide application, depot maintenance offers opportunities for interservicing to ensure that DOD resources are used in an optimal manner. When workloads are the same or similar, it is desirable from an economic standpoint that one Service support the entire wholesale workload.

In planning for a Depot Source of Repair (DSOR), three questions need to be answered:

- o Should the DSOR be organic or contract? A Service determination of whether organic or contract repair is preferable is determined through a process known as ***Decision tree Analysis (DTA)***.
- o If organic, which depot within the acquiring Service will be the candidate SOR? The Service ***depot planning process*** determines which of its depots should be a candidate for the workload being considered.
- o Should another Service's depot be a candidate? The ***Depot Maintenance Interservicing Studies and resulting DSOR decision process*** identifies the organic depot that will accomplish the workload being considered.

Decision Tree Analysis

Each Service uses its own logic, but all ask the same or similar decision questions to determine if depot maintenance should be provided by contract or by an organic source. Consider if a workload is essential to the combat mission or if it is critical to the industrial (depot) support base and therefore is a core workload. In this case, are there obstacles that prevent organic support? One such obstacle might be that the developing Service did not buy the technical data needed to establish organic capability. If there are no obstacles, an organic capability should be established.

If there is an obstacle which prevents organic support and the contractor can provide wartime support at reasonable risk, contract support should be established. Otherwise, the Service is driven toward organic support.

Depot Business Planning:

The military Services are shifting to management of depot maintenance by business concepts. Prompted by the Defense Management Report of 1989 and by Defense Management Report Decision 908, 'Consolidating Depot Maintenance,' 17 November 1990, business planning is the means by which the depot maintenance community will evolve into the smaller, more efficient depot maintenance complex needed for the 1990's and beyond. Business planning seeks to promote business like, cost effective operations while maintaining the depot infrastructure necessary to meet each Service's military mission.

“Above-core” resources (and corresponding workloads) are assigned through business planning techniques such as depot maintenance interservicing.

To conduct business planning, each Service has established a business planning office at the Service/command logistics headquarters. The headquarters business office reviews workloading practices from an overall perspective and decides whether specific workloads are considered core, or whether they will be assigned through competition, interservicing, or consolidation.

Depot Source of Repair Decision

The program must contract for technical data to enable adequate planning and for logistics studies necessary to ensure supportability, sustainability, maintainability and reliability of the hardware being acquired. Timely acquisition of material management and maintenance data is essential to the completion of the Decision Tree Analysis (DTA), Service business planning, and joint Service DMI studies in order to obtain a DSOR assignment decision.

The acquiring command's MISO works closely with the hardware program office/acquisition logistics manager to identify potential DMI candidate workloads, and after submission for DMI study, to identify and develop data to support the DSOR decision process. The MISO also:

- a. coordinates actions to implement the DSOR decision and monitors depot activation.
- b. prepares, negotiates, and implements the DMISA.
- c. validates Service reviews and depot plans for the DSOR process, and submits DMI study candidates to JDMAG.
- d. gives Service approval on DSOR recommendations, and notifies his or her Service about joint DSOR decision.
- e. ensures implementation of joint Service DSOR decisions within the Service.

DMI Review Criteria

Equipment or systems that meet any one of the following criteria require a critical DMI review before the DSOR is assigned:

- a. All new acquisition or modification programs requiring depot maintenance support (both joint and single Service).
- b. All items planned for transition of depot support from organic to contract or contract to organic.
- c. All items for which a change in support requires an additional capital investment of \$100,000 or more for depot equipment or facilities.
- d. All depot workload realignments that affect existing DSOR decisions or DMI studies in process.