

OVERVIEW OF ARMY MAINTENANCE MANAGEMENT

1. Introduction. The primary mission of logistics is to ensure the operation of the weapon system on the battlefield. Logistics encompasses a broad spectrum of functions and responsibilities which are required in order that the Army mission might be achieved. In this discussion, we will look beyond the battlefield and beyond the weapon system to maintenance as one of several functional elements which make up the Army logistics system. As such, it must work toward the goal of the logistics system to provide the soldier in the field with what is needed, when, where, and in the condition and quantity required, at minimum expenditure of resources. Maintenance interrelates with other functional areas of logistics - those of supply, transportation, services and facilities - in the accomplishment of the logistics mission. Maintenance is not done for the sake of maintenance, but rather for the furtherance of the system which supports the soldier in the field. Army Regulation (AR) 750-1 provides the basis for Army maintenance concepts and policies and should be referred to for more detailed treatment of the subject.

2. Objective. The objective of this unit of instruction is to develop a basic understanding of the Army maintenance system. This instruction contains discussions of the structure in which maintenance is performed and the responsibilities of the various agencies/activities within this structure. We shall also list current maintenance policies, discuss the activities of maintenance engineering and maintenance operations, and the role of maintenance in satisfying the integrated logistics support requirements for a materiel system throughout its life cycle. Emphasis is put on relating maintenance activities to the life cycle systems management model.

3. Maintenance Definitions.

a. Maintenance is a functional area of logistics. The primary mission of logistics is to ensure the operation of a weapon system on the battlefield. The other four functional areas of logistics are: transportation, supply, facilities, and services. Maintenance interrelates with the other functional areas of logistics in the accomplishment of the logistical mission. Maintenance is not done for the sake of maintenance, but rather for the furtherance of the logistical system which supports the soldier in the field. As we described in the introduction to this unit, the goal of the Army's logistics system is to provide the soldier in the field with what is needed, when, where, and in the condition and quantity required, at a minimum expenditure of resources.

b. Maintenance is the function of sustaining materiel in an operational status, restoring it to a serviceable condition, or updating and upgrading its functional utility through modification and product improvement. Common maintenance functions include: inspect, test, service, adjust, calibrate, install, replace, and overhaul.

4. Maintenance Subfunction.

a. Maintenance is divided into two distinct yet closely interrelated functional areas: maintenance engineering and maintenance operations.

b. Maintenance engineering activities will:

(1) Participate in all phases of the materiel systems development.

(2) Provide maintenance concepts to the ILS manager and combat development communities for use in requirements formulation, design process, trade off analysis, and other materiel acquisition activities.

(3) Develop the maintenance aspects of the logistic support system.

(4) Conduct and sponsor research programs designed to improve the performance of both the maintenance engineering and maintenance operations subfunctions of materiel maintenance.

c. Maintenance engineering is involved in the earliest phase of the materiel acquisition model and continues to be developed and refined throughout the phases of the material acquisition life-cycle. Design for ease and economy of support is obtained by determining optimum levels of materiel reliability, maintainability, human factors, safety, and transportability design features and transmitting these features as requirements to design engineers.

d. The results of maintenance engineering activities are a firm system maintenance concept, support plans, and maintenance related specifications.

Maintenance engineering activity starts to peak as materiel is designed, developed and tested.

e. Maintenance concepts will be developed by maintenance engineering activities for all materiel systems. The maintenance allocation chart is developed from these concepts. In developing alternatives and selecting a final maintenance concept, the materiel developer will evaluate -

(1) Complexity of the materiel system.

(2) Mobility and transportability requirements.

(3) Operations readiness objectives.

(4) Operational and logistic environment in which the system will operate.

(5) Criticality of the materiel system.

(6) Support concepts for subsystems.

(7) Projected operating and support costs.

(8) Resource requirements.

f. The Maintenance Plan prepared by the materiel developer will incorporate the following principles where feasible:

(1) Minimize the need to disassemble materiel to perform maintenance tasks.

(2) Limit maintenance performed below general support to user upkeep and repair by replacement of modules and electronic Printed Circuit Boards (PCB's)/cards.

(3) Use repair cycle float (RCF) for mission essential materiel undergoing extensive repair on scheduled depot maintenance.

(4) Use concepts of Reliability Centered Maintenance (DA Pam 750-40).

(5) Repair and maintain at the lowest level of maintenance consistent with cost effectiveness and efficiency of performance.

(6) Design maintenance tasks and operations for execution during hostile conditions.

(7) Consider application of Army Oil Analysis Program concepts, field sampling, and sampling hardware.

5. Maintenance Operations.

a. Maintenance operations designate and assign the scope of maintenance to be performed by Army activities; provide policy for actions required to execute support planning for maintenance of materiel systems upon and after fielding; and establish requirements for management of programs and activities designed for the physical performance of maintenance tasks. Maintenance tasks consist of any action taken to retain or restore materiel to a fully mission capable condition. They include inspection, testing, servicing, classification for transfer, reclamation, repair, overhaul, modification, retrofit, calibration, or renovation. Maintenance tasks range from simple preventive maintenance checks and services performed by the operator of equipment to complex depot operations performed in fixed shop facilities.

b. The Army's maintenance support requires change to accommodate new battlefield environments, new equipment, and new methods of employment.

(1) Unit Maintenance. This is required maintenance performed on equipment assigned to a using organization.

(2) Direct Support Maintenance. This is required maintenance performed by designated maintenance activities in direct support of using units.

(3) General Support Maintenance. This is required maintenance performed by designated maintenance activities in general support of the theater supply system and back-up direct support to the direct support units in cases of heavy direct support workloads.

(4) Depot Maintenance. This is required maintenance performed by selected commodity-oriented organizations including special repair activities, AMC depots, and contract personnel.

c. The maintenance allocation chart remains the primary tool for assigning tasks. Equipment design will support the following sequence of priorities.

(1) Discard.

(2) Repair forward.

(3) Evacuate.

d. This will allow for greater use of the following items to provide improved forward maintenance to the user.

- (1) Built-in test/Built-in test equipment (BIT/BITE).
- (2) Modularity.
- (3) Discard of components and selected small end items.

6. Levels of Maintenance.

a. The levels of maintenance form the baseline for determining specific maintenance tasks to be assigned to each level. The basic purpose of the orientation of all levels in the materiel maintenance function is to maintain equipment in a state of readiness to support combat forces. The number of maintenance levels may be tailored to accommodate a specific materiel system or commodity grouping when justified by the materiel developer and DA.

b. Levels of maintenance are used as a means to select the scope of maintenance and the skill levels necessary for units and activities at various command levels. The responsibility to perform maintenance within a given level is assigned to a unit or activity under maintenance planning developed during the materiel acquisition phase. The levels of maintenance provide a means to manage maintenance operations by -

- (1) Relating maintenance operations to other military operations.
- (2) Making easier the assignment of responsibility for specific maintenance operation tasks to specified levels of command.
- (3) Permitting an orderly and efficient distribution of maintenance resources.
- (4) Ensuring maximum integration of maintenance tasks performed by personnel throughout maintenance operations.

c. The following is a review of the significant activities associated with each level of maintenance.

(1) Unit Maintenance - Unit maintenance is performed by a crew, the operator of the equipment, or unit maintenance personnel as shown in the maintenance allocation charts of the appropriate TM's or commercial manuals. It is characterized by quick turn-around based on repair by replacement and minor repairs. Unit maintenance consists of:

- (a) User's responsibility.
- (b) Employment of built-in test equipment (BITE) and modular replacement.
- (c) Crew/operator/unit checks and services (PMCS).

(2) Direct support maintenance is characterized by a highly mobile forward oriented and repair of items by replacement of unserviceable modules. The operations normally associated with intermediate direct support maintenance consist of:

- (a) Repair and return to user.
- (b) Operation of repair exchange activity to include the repair of designated unserviceable modules and components.
- (c) Stockage and issue authority of Operational Readiness Float (ORF).
- (d) Employment of highly mobile maintenance support teams (contact teams) for customer units.

(3) General support maintenance is characterized by semi-fixed facilities. Its fundamental purpose is to support the theater supply system through repair of equipment and components. Maintenance at this level will be job or production-line operations. The operations normally associated with intermediate general support maintenance consist of:

- (a) Repair of components and return to the area supply system.
- (b) Performance of back-up direct support maintenance.
- (c) Collection and classification of unserviceable or abandoned Class VII materiel for proper disposition.

(4) Depot Maintenance - depot maintenance operations support both the combat forces and the overall DA Inventory Management Program. The actions normally associated with depot maintenance consist of:

- (a) Industrial-type activities conducting industrial-type operations in support of the overall DA Inventory Management Program.
- (b) Modernization of serviceable assets.
- (c) Overhaul of end items and modules which are replaced by repair cycle float assets.
- (d) Normally depot maintenance is performed on a program basis; in most cases, a minimum of twelve (12) items will be required to make up a program. Readiness will be enhanced because the repair time will normally be shorter and cheaper than acquiring a new item.

7. National Maintenance Program.

a. Background. The features of NMM contrast with the previous maintenance process, Integrated Sustainment Maintenance (ISM), wherein repair requirements were regionally determined (CONUS or OCONUS). The items were repaired only as necessary and returned to the Retail Stock Fund at each installation. ISM repairs were to Technical Manual (TM) standards. In the NMM process, components will be repaired to a national standard, and returned to AWCF-SMA stock. The national standard (overhaul) is described in the appropriate National Maintenance Work Requirement (NMWR), Depot Maintenance Work Requirement (DMWR), or TM for each repairable component.

b. The National Maintenance Program (NMP) encompasses the Army strategy to move to a centrally coordinated and controlled repair-based logistics system. The overall objective is to increase fleet readiness at the weapon system level and reduce operation and sustainment costs by accomplishing repairs to a higher standard. The prescribed national standard will be described in the appropriate technical publication for each repairable candidate NIIN/NSN.

(1) NMP establishes two categories of maintenance management: National and field. The national category consists of organic depots, the industrial base, and qualified below-depot activities.

- (a) Items repaired are returned to the supply system.
- (b) The overall focus of the national category is sustainment readiness.
- (c) The source of funding for the national category of maintenance is AWCF-SMA.

(2) The second category of maintenance management is the field category. It consists of organizational, Direct Support (DS), and General Support (GS) maintenance units/activities.

- (a) The overall focus is near-term readiness in order to maintain and generate combat power.
- (b) Items are repaired and returned to user.
- (c) Source of funding is Operation and Maintenance (O&M).

(3) Headquarters, US Army Materiel Command, is designated as the National Maintenance Manager (NMM). The NMM focuses on centralized management, decentralized execution of Army maintenance programs, and consolidates all national maintenance organizations under a single management structure.

(4) National Maintenance Management (NMM) is a process based on the total Army need. NMM is the first source of supply to satisfy the national requirement for the AWCF-SMA. The selection of items and the quantity repaired to satisfy the national need are determined in an integrated Requirements Determination and Execution System (RDES). National Maintenance Management is a program for the repair of AWCF-SMA Class II, IV, and IX repairable components and their return to the AWCF-SMA account.

(5) The goal of NMM is to maximize national repair capability and available resources, providing required levels of weapon system repair parts with increased availability at the locations where the majority of demands are generated whenever possible.

(6) A single NMM structure consisting of national and installation maintenance managers oversees the execution of the scheduled maintenance programs. The NMM structure executes technical and programmatic staff supervision of the NMP. The MACOM Command, Control, and Communication (C3) structure provides a responsive business management structure capable of responding to and managing all Army sustainment maintenance activities at their installations.

(7) NMM management structure provides oversight of organic and contract maintenance activities and resources. AMC, through its subordinate commands, is responsible for organic and contractor-operated depot maintenance activities, and is responsible for workloading and funding repairs at organic and contractor-operated below-depot national maintenance activities. The NMM structure integrates the capacity and capabilities of all NMM maintenance activities, thus optimizing Army resources.

8. Maintenance Policies and Responsibilities.

a. Responsibilities:

(1) DA DCSLOG has overall staff responsibility for the management of maintenance operations. It provides guidance and policy, budgetary support, and oversees the Army's readiness posture.

(2) The Assistant Secretary of the Army for Research and Development has overall staff responsibility for the management of maintenance engineering. It is concerned with material design, development, engineering, RAM, and ILS funding.

(3) Combat developers (e.g., TRADOC) will formulate concepts for use as well as objectives and requirements.

(4) Materiel developers (e.g., AMC) will research, develop and produce a system responding to combat developers' objectives and requirements.

b. Maintenance policies:

(1) Maintenance is a command responsibility.

(2) There will be a single source of maintenance support for customer units.

(3) The organization of maintenance units will be flexible.

(4) Design of equipment will emphasize modularity.

(5) Equipment will be repaired only as needed.

(6) Maintenance tasks will be assigned by maintenance category through the MAC.

(7) Depot capacity/capability retained.

9. Maintenance Programs. Two significant maintenance programs which will be covered in detail during the course are Reliability Centered Maintenance (RCM) and the Army Oil Analysis Program (AOAP).

a. Introduction. A large percentage of defense spending is devoted to maintenance equipment. Consequently, when more efficient maintenance concepts are developed, these concepts are incorporated into developmental and fielded equipment whenever possible.

(1) One of the underlying assumptions of maintenance theory has always been that there is a cause-and-effect relationship between scheduled maintenance and operating reliability. It therefore followed that the more frequently equipment was overhauled, the better protected it was against the likelihood of failure. The only problem was in determining what age limit was necessary to ensure reliable operation. Over the years, however, it was found that many types of failures could not be prevented no matter how intensive the maintenance activities.

(2) Consequently, by the late 1950s, the airline industry had begun conducting studies of maintenance in order to discover a means of reducing costs. These studies of actual operating data began to contradict certain basic assumptions of traditional maintenance practice. One assumption is the belief that reliability is directly related to the intervals between scheduled overhaul. These maintenance studies indicated that for many items, a maintenance policy based exclusively on some maximum operating age would, no matter what the age limit, have little or no effect on the failure rate.

(3) As a result of these early studies, a task force was formed in 1960 to investigate the capabilities of scheduled maintenance. The results produced by this task force were used to develop a maintenance program for Boeing's 747 jet. This program was successful and has been further refined and applied to several other aircraft projects (Lockheed 1011, DC-10, F4, P-3, Airbus Industries A-300, and the Concord). This maintenance program is now called Reliability-Centered Maintenance (RCM).

(4) RCM is a scheduled maintenance program designed to realize the inherent reliability potential of equipment. The objective of RCM is to develop a scheduled maintenance program that ensures maximum safety and reliability of which the equipment is capable and meets this requirement at the lowest cost. RCM is based upon the premise that maintenance cannot improve upon the safety or reliability inherent in the design of the hardware. Good maintenance can only preserve those characteristics. The RCM concept uses decision logic to evaluate and construct maintenance tasks which are based on the equipment functions and failure modes. RCM employs a decision tree logic for assigning maintenance tasks. In RCM we have:

- (a) Hard time - fixed interval maintenance.
- (b) On condition - condition determined by scheduled inspection.
- (c) Condition monitoring - The condition is monitored during routine operation. This means that that particular maintenance task is unscheduled and it requires that the observer must be capable of detecting failure.

b. The other maintenance program we will discuss is the Army Oil Analysis Program (AOAP) which may be considered as a subfunction of RCM in that it provides data for "on condition" monitoring of equipment maintenance. The Army Oil Analysis Program is a coordinated, Army-wide effort to detect impending material component failure and/or oil condition through the spectrometric analysis for trace wear metals. The Army Oil Analysis Program is especially effective in identifying impending material component failure and permitting the supporting unit to perform necessary repair/replace actions before larger system failure occurs. Such early identification of impending component failure facilitates equipment repair operations and boosts equipment readiness. Feedback to the laboratory of equipment condition is essential to refine evaluation criteria to increase the accuracy of laboratory predictions, and to recommend design changes in those major assemblies showing an abnormal failure rate through the Army Oil Analysis Program.

10. Summary. In summation, this block of instruction should have provided you with an overview of the concepts, policies, and programs of Army maintenance and Army maintenance management as well as a brief introduction to some of the areas of in-the-field maintenance that this course will focus on. To highlight a few of the points we touched on: we described the definition of maintenance and the relation of Army maintenance to the Army logistics system. We detailed the two subfunctions of maintenance: maintenance engineering and maintenance operations and discussed each in detail. We looked at the current four categories of maintenance. We reviewed the responsibilities and activities of the key players in the national level maintenance program as well as key maintenance policies. And lastly, we discussed two maintenance programs - Reliability Centered Maintenance and the Army Oil Analysis Program.

Exhibit A

Common Maintenance Functions

- 1. Inspect.** To verify serviceability and detect incipient electrical or mechanical failure by close visual examination.
- 2. Test.** To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of the item and comparing those characteristics with authorized standards.
- 3. Service.** Operations required periodically to keep the item in proper operating conditions; i.e., clean, preserve, drain, paint, and replenish fuel, lubricants, hydraulic, and deicing fluids or compressed air supplies.
- 4. Adjust.** To regulate periodically to prevent malfunction.
- 5. Calibrate.** To determine, check, or rectify the graduation of an instrument, weapon, or weapon system or components of a weapon system.
- 6. Install.** To set up for use in an operational environment such as an emplacement, site, or vehicle.
- 7. Remove and install.** Remove and install the same item for service or, when required, for the performance of the maintenance functions.
- 8. Replace.** To substitute serviceable components, assemblies, and subassemblies for unserviceable counterparts.
- 9. Repair.** To restore to a serviceable condition by replacing unserviceable parts or by any other action required, using available tools, equipment, and skills including welding, grinding, riveting, straightening, adjusting, facing, etc.
- 10. Overhaul** is the highest level of maintenance operations normally performed on Army equipment. It will normally be allocated to the depot maintenance category and performed either in organic DOD depot maintenance facilities or by commercial firms under contract. The overhaul of Army equipment will be accomplished based upon specific criteria and work requirements developed in accordance with depot maintenance work requirements (DMWR).

Exhibit B**GENERAL DESCRIPTION FOR ORGANIZATIONAL AND OPERATIONAL POLICIES FOR MAINTENANCE**

In the main, the statements listed below reflect the way maintenance is viewed in the operational sphere, and should provide the maintenance engineer who is involved in developing the maintenance concept for a new system with a baseline organizational and operational concept for maintenance activities.

1. Each commander is responsible for the maintenance of equipment issued to his organization.
2. Maintenance will be performed in accordance with published maintenance doctrine at the lowest category consistent with the tactical situation and available facilities, skills, man-hours, repair parts, tools, and test equipment.
3. Repairs will be accomplished as far forward as possible. (Bring the repairer to the equipment rather than evacuate to lowest level that can perform the maintenance action.)
4. Maintenance will be accomplished in accordance with the applicable Maintenance Allocation Chart (MAC) which assigns specific repair tasks to specific levels of maintenance.
5. Unserviceable materiel which is beyond the maintenance authority or capability of an organization will be reported or evacuated promptly to the organization responsible for the next higher level of maintenance.
6. Unless precluded by the operational situation, all authorized maintenance within the capability of an organization will be accomplished before equipment is evacuated to the next higher level of maintenance. Higher levels will perform the maintenance functions of lower levels when directed by appropriate commanders.
7. Each unit will possess an organizational maintenance capability to the greatest extent practicable, considering the size of the unit, its mission, the economy of resources, current maintenance doctrine, and the operational environment.
8. Inspect and Repair only as necessary.
9. Continuous command emphasis on the prompt evacuation of reparable unserviceable components and end items to maintenance activities is mandatory for timely maintenance contributions to materiel readiness.

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