MCWP 4-24

Maintenance Operations

U.S. Marine Corps

PCN: 143 000017 00

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DEPARTMENT OF THE NAVY
Headquarters United States Marine Corps
Washington, DC 20380-1775

24 April 1998

FOREWORD

1. PURPOSE

Marine Corps Warfighting Publication (MCWP) 4-24, *Maintenance Operations*, provides the commander with the basic information on the Marine Corps' maintenance system and how the system is employed to maintain a unit's equipment in a combat-ready condition.

2. SCOPE

MCWP 4-24 sets forth essentials of the Marine Corps' equipment maintenance system from the perspective of the unit commander. It provides a practical approach to understanding maintenance management of ground equipment that can be applied without any significant technical background. Maintenance policies and procedures for aircraft and other Navy-procured equipment are outlined in OPNAVINST 4790.2, *The Naval Aviation Maintenance Program (NAMP)*.

3. SUPERSESSION

FMFRP 4-15, *Commander's Guide to Maintenance*, 4 September 1990.

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

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Maintenance Operations

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Chapter 1

Maintenance Overview

"It is a command responsibility to ensure that assigned materiel is maintained in operating condition to perform designated functions effectively."[1]—*Marine Corps Manual*

MCDP 4, *Logistics*, indicates that "the complexity of the tasks involved in supporting a high technology force also increases as the sophistication of its weapons and equipment increases."[2] Quite simply, the more advanced the equipment, the harder it is to fix. Couple this with the notion of generating ever-increasing tempo in reduced response time over greater distances and maintenance becomes a significant challenge. To meet this challenge and ensure combat readiness, commanders must be maintenance oriented and have a basic understanding of the Marine Corps' maintenance system. The purpose of maintenance is simple and direct—to keep equipment in service. Accordingly, commanders must emphasize maintenance at every level of command.

1001. Maintenance Definition

Maintenance is one of the six functional areas of logistics. It consists of—

> "**1.** All action taken to retain materiel in a serviceable condition or to restore it to serviceability. It includes: inspection, testing, servicing, classification as to serviceability, repair, rebuilding, and reclamation. **2.** All supply and repair action taken to keep a force in condition to carry out its mission. **3.** The routine recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such condition that it may be continuously utilized, at its original or designed capacity and efficiency, for its intended purpose."[3]

Our Service policy (MCO P4790.2, *MIMMS Field Procedures Manual)* also considers efforts to update and upgrade the capability of materiel as a maintenance function.

1002. Maintenance Subfunctions

a. Inspection and Classification

Inspection and classification are the first and last tasks that a user and maintenance activity perform on equipment.

Inspection is the checking or testing of an item against established standards. The inspection process determines maintenance requirements and satisfactory maintenance performance. It determines if something is wrong with the equipment. All echelons of maintenance include inspections. Inspections are most effective when the inspector is not the person who performs the maintenance.

Classification is the assignment of an item to a maintenance category based on established procedures. The assigned classification determines who repairs the item and where the repairs are made.

When an item is evacuated to a higher echelon, the higher echelon's repair organization also inspects and classifies equipment for serviceability/failure using tools and techniques unavailable to the lower echelon. This re-checking by the higher echelon confirms the results of the lower echelon's inspection. The higher echelon also performs a final inspection and classification before returning the equipment to the lower

echelon. This confirms that the appropriate repairs were completed. The owning unit's maintenance organization performs the final equipment inspection and classification before placing the item back in service.

b. Servicing, Adjustment, and Tuning

Servicing, adjustment, and tuning tasks do not have precise definitions. Servicing may include all repairs or maintenance, including adjustment and tuning. Tuning is a process of adjusting equipment to achieve precise functioning. For example, tuning often refers to engine adjustments; however, engines are not the only components that need adjustments. Regardless of precise definitions, the terms have one thing in common: they refer to maintenance performed on operable equipment, including equipment that the maintenance activity has just repaired.

c. Testing and Calibration

Testing and calibration are terms that apply to the maintenance of precision instruments. These instruments may be components of larger items, or they may be maintenance test equipment. Testing compares the accuracy of the instrument to an established standard. Calibration is the adjustment of precision instruments that have deviated from their standards.

d. Repair

Repair is the return of an item to serviceable condition through correction of a specific failure or unserviceable condition. The repair cycle starts when the maintenance activity removes an unserviceable part or reparable component. It ends when the maintenance activity reinstalls the replacement part or reparable component and places the equipment back in service.

Joint Pub 1-02 defines a reparable item as "an item that can be reconditioned or economically repaired for reuse when it becomes unserviceable." A maintenance activity reconditions or repairs a reparable component after its removal and keeps it in stock for reuse when the same type of component becomes unserviceable on another item of equipment. These are often referred to as "secondary reparables," "secreps," or "line replacement units." See chapter 3 for more information on secondary reparables.

Two repair techniques are cannibalization and selective interchange. Maintenance by cannibalization or selective interchange is considered to be an exceptional procedure. It is authorized only when an operational commitment is imminent and the required part or reparable component may not be available from stock or obtained in time. Maintenance by cannibalization and selective interchange is decided case-by-case. It can only be authorized by the Commandant of the Marine Corps, DC/S Installations and Logistics, Logistics Plans Policy and Strategic Mobility Division (HQMC code: LP); a major subordinate command commander, and commanders of any unit authorized third echelon repairs.

(1) Cannibalization. Cannibalization is the removal of serviceable parts from an unserviceable item of equipment and installing it on another unserviceable item to make it serviceable. Cannibalization does not address the replacement of the removed serviceable repair part/component; however selective interchange does.

(2) Selective Interchange. Selective interchange is the exchange of selected serviceable parts/components from a deadlined item of equipment for unserviceable repair parts/components from a like item. The maintenance activity is required to immediately reuse or requisition the parts to repair other items of equipment. Selective interchange can decrease the time to repair an item and return it to the user. Selective interchange is commonly recognized as a lesser degree of cannibalization.

e. Modification

Modification changes the design or assembly characteristics of systems, end items, components, assemblies, subassemblies, or parts. A modification's purpose is to improve equipment

functioning, maintainability or reliability (usually issued as a normal modification), or its safety characteristics (typically seen as urgent modifications). Maintenance activities routinely apply normal modifications to upgrade otherwise operable equipment. However, in circumstances that require urgent modification, the item may be placed in an administrative deadline status, pending application, to prevent possible damage or unsafe operation. Extensive modifications are referred to as product improvements and are managed separately from modifications. See chapter 2 for additional information.

f. Rebuilding and Overhauling

Rebuilding restores items to like new condition. The rebuilt item's appearance, performance, and capabilities are the same as originally manufactured. Overhauling restores items to a serviceable condition under maintenance serviceability standards. Rebuilding is a depot maintenance function. Depending on the item, overhauling may be either a depot or intermediate maintenance function. When rebuilding or overhauling an item, the maintenance activity also performs required modifications that were not previously applied.

g. Reclamation

Reclamation is action taken to restore condemned, scrapped, abandoned, or damaged materiel, parts, and components. Reclamation actions include repair, refabrication, or renovation. The maintenance activity returns reclaimed items to the supply system. Reclamation is a depot function.

h. Recovery and Evacuation

Recovery is the process of retrieving or freeing immobile, inoperative, or abandoned materiel. It includes returning it to operation or taking it to a collection point for repair, evacuation, or disposal. Recovery is the responsibility of the owning unit. Evacuation moves materiel from one combat service support (CSS) maintenance activity to another for repair or disposal. It includes moving equipment between the owning unit's maintenance site and the supporting combat service support element (CSSE). Evacuation is the responsibility of the combat service support element.

1003. Categories of Maintenance

Three categories of maintenance exist within the Marine Corps' ground equipment maintenance system: organizational, intermediate, and depot. Within these three categories are five echelons of maintenance. Each category and echelon is authorized to perform certain maintenance functions on certain commodity area items of equipment (e.g., communications, ordnance, motor transport). This capability is normally listed in a unit's table of organization (T/O) mission statement. Maintenance units are not restricted to performing only one echelon of maintenance. For example, a unit may be authorized to perform first and second echelon maintenance or even third or fourth. To manage maintenance effectively, commanders must understand their maintenance responsibilities and the maintenance responsibilities of those units in support.

a. Organizational Maintenance

The using unit performs organizational maintenance on its assigned equipment. All units within the Marine division, force service support group (FSSG), and aircraft wing possess the organizational capabilities to maintain their organic equipment. Organizational maintenance focuses on the operator and crew preventive/corrective measures required by technical publications, equipment failure, and service schedules. Organizational maintenance phases normally consist of inspecting, servicing, lubricating, adjusting, and replacing parts, minor assemblies, and subassemblies. Organizational maintenance includes first and second echelon maintenance responsibilities.

First echelon maintenance is performed by the user or equipment operator. This maintenance includes the proper care, use, operation, cleaning, preservation, lubrication, adjustment, minor

repair, testing, and parts replacement prescribed by appropriate technical publications. Collection of Marine Integrated Maintenance Management System (MIMMS) information is not required for first echelon maintenance.

Second echelon maintenance includes the performance of scheduled maintenance, diagnosis and isolation of previously identified and traced equipment malfunctions, replacement of major assemblies/modular components that can be readily removed/installed and do not require critical adjustment, and replacement of easily accessible piece parts not authorized at first echelon. Second echelon maintenance is performed by specially trained personnel in the organization. Specific publications authorize second echelon, maintenance-capable units to hold additional tools, supplies, and test equipment that support a higher echelon of maintenance.

b. Intermediate Maintenance

Intermediate maintenance is the responsibility of and performed by designated maintenance activities in direct support of using organizations. Intermediate maintenance phases normally consist of calibration, repair, or replacement of damaged or unserviceable parts, components, or assemblies; the emergency manufacture of nonavailable parts; and providing technical assistance to using organizations. Intermediate maintenance includes third and fourth echelon maintenance. See MCO P4790.2 for detailed information.

Note: Some elements of third and fourth echelon maintenance can be performed at either the intermediate or organizational levels dependent on the capability assigned in the T/O mission statement of certain commodity-peculiar organizations (e.g., tank battalion, communications battalion, light armored reconnaissance battalion).

Third echelon maintenance is performed by specially trained personnel and can include—

- Diagnosing and isolating equipment/modular malfunctions.
- Adjusting and aligning modules using test, measurement, and diagnostic equipment (TMDE).
- Replacing modular components and piece parts that do not require extensive post maintenance testing or adjustment.
- Cleaning modular components and performing limited repair if needed.
- Installing replacement seals.
- Applying external parts.
- Installing repair kit pieces.
- Performing minor body work.
- Evaluating emissions of internal combustion engines.

Fourth echelon maintenance is normally associated with semi-fixed or permanent shops of intermediate maintenance activities. It is frequently associated with organizational shops of units that have a commodity-peculiar mission. Fourth echelon can include—

- Diagnosing, isolating, adjusting, calibrating, aligning, and repairing malfunctions to internal piece/part levels.
- Replacing defective modular components not authorized at lower echelons.
- Repairing major modular components by grinding and adjusting items such as valves, tappets, and seats.
- Replacing internal and external piece parts to include solid-state integrated circuits and printed circuit boards/cards.
- Performing heavy body, hull turret, and frame repair.

c. Depot Maintenance

Depot maintenance is performed on materiel that requires a major overhaul or a complete rebuilding of parts, assemblies, subassemblies, and end items. This level of maintenance includes the manufacture of parts, modifications, testing, and reclamation, as required. Depot maintenance supports lower categories of maintenance by providing technical assistance and by performing maintenance that exceeds the lower categories level of responsibility. Depot maintenance also provides stocks of serviceable equipment that are not available in lower echelon maintenance

activities. Depot maintenance includes the fifth echelon of maintenance.

Note: Fifth echelon maintenance can be performed at intermediate maintenance activities if specifically authorized by the Commandant of the Marine Corps.

Fifth echelon maintenance includes—

- Overhauling or rebuilding end items or modular components.
- Performing repairs that exceed the assigned capability of lower echelons of maintenance (special environmental facilities or specific tolerances are required).
- Performing nondestructive testing.
- Performing special inspection/modification that requires extensive disassembly or elaborate test equipment.
- Manufacturing items not provided or available.
- Providing wholesale direct exchange support.

1004. Class VIII (Medical/Dental) Maintenance

Class VIII medical and dental equipment have specific maintenance requirements that differ from normal Marine Corps maintenance procedures for ground combat equipment. MCBul 4790, *Maintenance Management of Marine Corps Class VIII Equipment*, provides maintenance management policies and procedures for Marine Corps medical and dental equipment.

Chapter 2

Maintenance Management

"Equipment is manufactured at great expense. It is shipped 5000 miles by train, ship, and truck. It is issued to the troops and eventually, with great labor, carried to the top of a mountain in Korea. How many times, at the last point, has the whole enormous effort been thrown away, as carelessly as a burnt match, by the happy-to-lucky negligence of the very people whose lives depend on keeping the stuff in shape?"[1]—FMFRP 12-14

Maintenance management is the systematic approach to the maintenance of organizational equipment. There are four principal concerns in maintenance management: command, resources, production, and information. The ability to plan, organize, staff, direct, and control a command's ground equipment maintenance program is the foundation for sustainment in combat.

2001. Command

Among the four principal concerns of maintenance management, command is the most significant. Command contains four key elements that commanders use to focus and fulfill their responsibilities. These elements are interest, organization, policies, and procedures.

a. Interest

Command interest must reflect the responsibility inherent in command for equipment readiness. Commanders are not expected to possess a technician's or a mechanic's expertise, but they are expected to demonstrate sincere interest in their unit's maintenance program. Their interest is essential to a successful ground maintenance program. Commanders' interests motivate personnel to maintain a high level of excellence.

b. Organization

Typically, commands authorized second echelon or higher maintenance for more than one commodity area have maintenance management officers. If a maintenance management officer is not identified in organizational structure, commanders should assign, in writing, maintenance management officer responsibilities as an additional duty. The maintenance management officer coordinates and integrates command efforts in the maintenance management functional areas listed in figure 2-1.

c. Policies

Commanders at major subordinate commands are required to publish maintenance management standing operating procedures (SOP). The SOP will not contain all subordinate unit functions. However, it should be applicable at the unit level and adequately detailed to ensure that each subordinate unit can perform its maintenance mission.

Maintenance Administration
Personnel and Training
Records and Reports
Publications Control
Equipment Availability
Preventive Maintenance Checks and Services and Corrective Maintenance
Supply Support
Maintenance-Related Programs

Figure 2-1. Functional Areas of Maintenance Management.

Commanders at subordinate command levels (including detached or separate commands) authorized to perform second echelon maintenance or higher for more than one commodity area must publish a maintenance management SOP. If maintenance procedures are adequately covered in the major subordinate command's maintenance management SOP, then subordinate commanders are not required to publish one for the unit.

Commanders at subordinate command levels (including detached or separate commands) authorized to perform only first echelon maintenance for organic equipment must publish, as a minimum, a unit logistic SOP or a maintenance policy letter. The SOP or policy letter addresses maintenance management procedures not covered by the major subordinate command's maintenance management SOP.

d. Procedures

The frequent change of personnel within a unit can result in a lack of expertise and continuity within day-to-day operations. To reduce these effects and increase overall unit efficiency, commanders emphasize the use of desktop procedures and turnover folders. Desktop procedures are not intended to be inclusive or formalized, they are a simple listing of significant items pertinent to everyday operations within a particular billet. Turnover folders focus on policy information, status of pending projects, references, management controls, functioning of the section, techniques used to accomplish routine and infrequent tasks, and personnel information. Desktop procedures and turnover folders do not apply to all billets and should be applied in accordance with MCO P4790.2.

2002. Resources

Maintenance resources consist of time, personnel, repair parts, tools and support equipment, facilities, publications, and funds. Commands must have authorization to possess these resources. There are three principal documents that list a command's authorized level of maintenance resources: tables of equipment (T/E), tables of organization (T/O), and tables of authorized materiel (TAM).

A table of equipment lists the equipment that commands are authorized to possess for mission accomplishment.

The table of organization indicates the maintenance authority of each unit based on its capabilities, personnel, equipment, and wartime mission. The T/O logistic capability statement determines personnel skills and equipment requirements. Its organization paragraph identifies the unit's subordinate elements, source of internal maintenance support, and unit maintenance requirements. The table of organization also contains the unit's concept of employment, which is vital to the commander and staff in determining the type of support required and how to obtain the required support.

The table of authorized materiels is a listing of information used for logistic planning with respect to selected materiel authorized for use by the Marine Corps (both regular and reserve). Materiel is listed by subsistence; petroleum, oil, and lubricant items; and type:

- Type I. Required Items.
- Type II. Local Allowances.
- Type III. Environmental Items.

a. Time

Time must be viewed from two aspects: the equipment and the mechanic.

(1) Equipment. The maintenance management officer maximizes equipment availability by establishing an effective preventive maintenance program and by eliminating shortages of maintenance resources that reduce maintenance production. Shortages can include a lack of tools, publications, space, parts, skills, supervision, and

funds. When these items are not available at the work site, time is wasted.

(2) Mechanic. Optimally, mechanics should spend their time maintaining and repairing equipment to a combat-ready status. Realistically, mechanics could spend a majority of their time on maintenance training, administrative duties, and other miscellaneous requirements. Therefore, effective time management demands that these nonmaintenance requirements be consolidated into blocks and coordinated with the appropriate cognizant staff officers, subordinate commanders, and noncommissioned officers in charge in order to reduce the impact of these nonmaintenance, yet related, activities to a mechanic's primary duty. Only after a mechanic's productivity has been maximized can the command determine if adequate time has been allocated for equipment maintenance and repair.

Note: If mechanics are still unable to perform repair/maintenance activities within the allocated time, then either the available maintenance time must be increased, the workload reduced, or a degraded level of readiness accepted. Some techniques for making these tradeoffs include administrative storage, split shifts, and reduced operations.

b. Personnel

The success of a unit's maintenance effort is heavily influenced by its quantity and quality of personnel. The maintenance management officer coordinates an annual review of the table of organization by the equipment commodity section and recommends changes to the commanding officer and G-1/S-1. Additionally, the table of organization should be reviewed whenever the logistic capabilities statement, concepts of employment, or capability statements change.

The maintenance management officer also ensures that maintenance and maintenance management training requirements are included in the unit's annual training plan. The annual training plan must address both mission and military occupational specialty training as well as operator and supervisor training.

Personnel safety is also a constant concern. Continuous vigilance by all maintenance personnel is required to ensure that operating procedures and work methods do not expose personnel to injury or equipment to damage or loss.

c. Repair Parts

In this publication, repair parts refer to consumable repair parts and secondary reparables. Commanders must ensure that repair parts and maintenance-related supplies are requisitioned when required, properly accounted for, and safeguarded.

(1) Requisitioning. Repair parts must be placed on requisition as soon as possible after a requirement is identified. The need must be consistent with the urgency and submission standards stated in MCO 4400.16, *Uniform Material Movement and Issue Priority System.* Units use the equipment repair order shopping/transaction list (EROSL) to requisition all repair parts and maintenance-related supplies for units supported by the Field Maintenance Subsystem (FMSS). Use of the EROSL or DD Form 1348 is optional for non-FMSS supported units. Reconciliation of supply requisitions between the maintenance section and its supply source must occur at least every 2 weeks to review the status of repair part requisitioning.

(2) Accounting. Repair parts are accounted for by an equipment repair order (ERO) parts bin, sometimes referred to as a layette. A copy of the EROSL must be maintained in the layette. Parts for a pending job are placed in an ERO bin that is designated for that specific job until all parts are received and maintenance personnel are available to effect repairs. All parts for the same equipment repair order are kept together in the same bin and the location is normally indicated by ERO numbers. Large parts may not fit into a bin and must be kept in another area; these parts are stored together and must be marked with the applicable

ERO number. The EROSL must indicate the alternate storage location.

Materiel stored in ERO bins must be inventoried and validated at least every 2 weeks. EROSLs are annotated to indicate all repair parts, receipts from supply sources, removal from the bin, transfers, and application to the equipment.

Another method of accounting and stocking repair parts is a pre-expended bin. Pre-expended bins ensure adequate stockage of fast-moving items resulting in an across the counter issue rather than a back order. Pre-expended bins can save commanders time and money, and they can maintain readiness. MCO P4400.150, *Consumer Level Supply Policy Manual*, gives specific guidance on establishing and maintaining pre-expended bins.

d. Tools and Support Equipment

Tools and support equipment refer to tool sets, kits, chests, hoists, jacks, and stands. Loss of tools slows maintenance and increases costs. Therefore, proper inventory procedures and effective control measures must be employed to reduce loss of tools. Defective tools and equipment are also a safety hazard, and they are detrimental to the unit's equipment readiness. Tools and support equipment are often classified and referred to as support equipment and test, measurement, and diagnostic equipment.

The unit maintenance management officer establishes tool control and calibration control programs for the unit. These programs ensure accountability and serviceability. They must also balance the need for access to tools to increase productivity and the need to reduce tool and equipment loss. Specific tool inventory requirements are found in MCO P4400.150.

e. Facilities

The maintenance management officer has prime staff responsibility for the allocation and use of maintenance facilities between commodity areas. Staff functioning affects site selection, shop layout, and shop organization. See chapter 6 and appendix A for more information.

f. Publications

Publications control system operations are normally managed by the S-1/adjutant, supply officer, and maintenance management officer. Publications control is divided into four functional areas: automatic distribution control, internal distribution control, inventory control, and order control.

(1) Automatic Distribution Control. The automatic distribution control system is managed via the publications listing. The publications listing identifies all publications automatically distributed to an activity from the publications stock control point at Marine Corps Logistics Base, Albany, Georgia. The activity's S-1/adjutant, with the advice and assistance of the maintenance management officer, maintains and reviews the publications listing and ensures that all necessary publications are listed. An outdated publications listing can cause the activity to go without essential information and/or receive publications that are no longer required. MCO P5600.31, *Marine Corps Publications and Printing Regulations*, contains procedures concerning the publications listing. The UM-MCPDS, *Marine Corps Publications Distribution System (MCPDS) Users Manual*, provides detailed guidance on the automated Marine Corps Publications Distribution System.

(2) Internal Distribution Control. The publications internal distribution control system ensures that publications received on automatic distribution are properly routed to those who need them. The internal distribution control system is managed by the S-1/adjutant with the advice and assistance of the maintenance management officer. To be effective, a publication's location and quantity must be annotated on either a local distribution control form or in an automated control system. MCO P5600.31 provides detailed guidance for the establishment of an internal distribution control system and the preparation of an

internal distribution control form. Commodity managers must understand the internal distribution control system in order to properly manage publications and recommend timely changes to the internal distribution control form and the publications listing.

(3) Inventory Control. The inventory control system manages publications libraries. An effective inventory control system must ensure the adequacy of two elements: publications conditions and on-hand quantities. Publications conditions relate to the status of directives and publications on the library shelf. Publications must be up-to-date with all changes properly entered. On-hand quantities must match the total quantities shown in the "location of copy" column on the internal distribution control form. The UM-PLMS, *Marine Corps Publications Library Management System (PLMS) Users Manual*, provides guidance regarding the Marine Corps Publications Library Management System (PLMS).

There are two types of inventory methods used: wall-to-wall and update inventories. Wall-to-wall inventories are conducted when libraries are in extreme disrepair. Update inventories are conducted when either an updated NAVMC 2761, *Catalog of Publications*, SL-1-2 that contains an index of authorized publications for equipment support, or SL-1-3 that contains an index of publications authorized and stocked by the Marine Corps is received.

(4) Order Control. The order control system is an outgrowth of the inventory control system. When publications become worn out or on-hand quantities do not match total quantities, units must replace damaged or missing publications. Units order publications through the Marine Corps Publications Distribution System. An effective requisition control system depends on the regular reconciliation of individual libraries with the unit publication control point.

g. Funds

If a maintenance section is adequately funded, it has the necessary repair parts, tools, and other maintenance-related supplies available. Funds (dollars, budgets, or operating targets) are not directly seen by the maintenance management officer or maintenance sections. Even though the impact of funding is indirect, the role of the maintenance management officer is vital. The maintenance management officer's main funding responsibility is to establish a budget and control fund outflow.

(1) Budgeting. The maintenance management officer's first task in the budgeting process is to collect and evaluate previous expenditure information. The maintenance management officer uses automated information systems to obtain expenditure information. A review of the historical expenditure information must include a check for correctness and consider expenses that are not covered on automated information system reports. Past expenditures will not indicate future needs unless the past expenditure is compared to future operations, logistic commitments, and new equipment receipts. Once all information is gathered, the maintenance management officer can assist commodity and maintenance sections in forecasting funding requirements.

(2) Control. Funds must be controlled once they are allocated. The maintenance management officer provides staff advice on internal allocation of money. The maintenance management officer ensures that funds obligated for maintenance resources are applied in the best manner and that periodic fiscal reviews are conducted. The maintenance management officer provides control by coordinating with supply and fiscal officers and presenting the commander with the information needed to determine reallocation of funds, to cancel requisitions, or to request additional funds. To facilitate the control of funds, the maintenance management officer, in conjunction with the unit's supply and fiscal officer and in

coordination with the command's comptroller, develops a unit's job order number structure. This structure allows easier information collection and sound decisionmaking because expenditures are listed by maintenance commodity area (e.g., motor transport, engineer).

2003. Production

Production is the physical performance of various maintenance functions. These functions include preventive maintenance checks and services (PMCS), corrective maintenance, modification, calibration, conversion, modernization, overhaul, and rebuild. Some of the functions are generally performed only by depots, while others are performed by field units (see table 2-1). Actions related to maintenance production (recovery, quality control, and equipment inspection) are also discussed in the following subparagraphs. These functions are embedded within the four phases of the maintenance process.

a. Maintenance Phases

The maintenance process consists of four maintenance phases. These phases include the acceptance of equipment, equipment induction, active maintenance, and maintenance closeout.

(1) Acceptance of Equipment Phase. The acceptance of equipment phase is the initial step of the maintenance process. It consists of an acceptance inspection, scheduling, and assignment. The purpose of the acceptance inspection is to verify that equipment is complete and prepared for the required maintenance service (e.g., operator maintenance was performed and equipment was cleaned). Equipment that is incomplete (missing equipment parts or records) or not properly prepared by the unit or activity requesting maintenance should not be accepted into the maintenance cycle until discrepancies are corrected.

Once equipment is accepted it is given a work priority based on the ERO priority, operational requirements, and available maintenance resources. Based on the assigned priority, the equipment is then scheduled to arrive at the maintenance facility at, or immediately before, the time maintenance resources are available. The equipment is held by the owning unit in a unit recall status until facilities/personnel are available to conduct maintenance actions and the unit is contacted. Until that time, operationally safe equipment is returned to the using unit, which gives the owner maximum use and avoids congestion at maintenance sites. The assignment of equipment to a specific maintenance shop within the maintenance section occurs upon completion of the acceptance inspection and scheduling.

(2) Equipment Induction Phase. Induction is the physical commitment of an ERO and its associated equipment to a specific shop. Delivery of the equipment from the owning unit is requested once the maintenance shop is capable and ready to perform maintenance actions. This request should be given to the using unit or appropriate coordinator as soon as possible. Induction of

Table 2-1. Maintenance Production Functions.

Preventive Maintenance Checks and Services	Corrective	Overhaul	Rebuild
Calibration	**Modification**	**Conversion**	**Modernization**
Field Functions		**Depot Functions**	
1. Preventive maintenance checks and services.		1. All field functions.	
2. Corrective maintenance.		2. Overhaul.	
3. Calibration.		3. Conversion.	
4. Modification.		4. Rebuild.	
5. Fabrication.		5. Modernization.	

equipment into a specific shop is determined by the priority assigned during the equipment acceptance phase in accordance with the priority requested by the owning unit.

(3) Active Maintenance Phase. Production actions performed following induction of the ERO and its associated equipment into a maintenance shop constitute the active maintenance phase and the beginning of the repair process. This phase is performed in a sequence of logical steps designed to ensure that the required services are conducted in an efficient and effective manner. Continual emphasis is placed on the quality control of the actions and tasks performed. The frequency of quality control inspections depends on the skill and experience of the individual technicians or mechanics and the overall complexity of the actions. The following steps are conducted during active maintenance.

(a) Inspection of Equipment. The initial step involves a detailed inspection of equipment by maintenance personnel. This inspection is the foundation of the maintenance process and includes locating and identifying equipment malfunctions, inventorying the equipment and its contents, and verifying that all equipment records associated with the required service are prepared in accordance with current publications.

(b) Preparation for Maintenance Actions. Preparation for maintenance actions includes the assembly of the appropriate technical publications and other technical information; support equipment; and test, measurement, and diagnostic equipment to perform the required services. Adequate preparation reduces the actual time required to perform the maintenance and avoids initiating maintenance actions if resources are not available.

(c) Performance of Maintenance. Performance of all maintenance actions is per the appropriate technical publication. Maintenance actions include performance of preventive maintenance checks and services, corrective maintenance, application of modifications, and calibration. Once maintenance actions are completed, the equipment is given final adjustments. Bringing the equipment performance to within specified tolerances is a positive indication that the action has been successfully completed.

(d) Quality Control. Quality control requires a complete equipment check to determine proper completion of maintenance actions and that equipment records are completed per TM 4700-15/1, *Ground Equipment Record Procedures*. Equipment not performing satisfactorily is rejected and recommendations are made for further maintenance actions. Acceptable performance results in the completion of the active maintenance phase and the movement of the equipment to the closeout phase. Quality control should be performed by experienced maintenance personnel since this is the last opportunity to catch any deficiencies before equipment is returned to operation.

(e) Cleanup of Maintenance Area. Time and resources must be allocated to cleanup the maintenance area. Support, test, measurement, and diagnostic equipment, (including tools) must be cleaned, serviced, and inventoried to facilitate future maintenance actions. Technical publications must be returned to their proper locations. Defective parts and other residue must be removed from the maintenance area using proper disposal procedures.

(4) Maintenance Closeout Phase. The closeout phase of the maintenance process commences when equipment has been repaired and the serviceable item is returned to the owner or when a decision has been made to evacuate or dispose of the equipment. Maintenance personnel must ensure that the closeout process is accurate, complete, and coordinated. This includes ensuring that the ERO and equipment records are correctly completed. The closeout phase requires close coordination with owning unit personnel to ensure that they are notified as soon as the equipment is ready for pickup. This reduces vehicle congestion at the maintenance facility and allows the using unit to employ all of its assets. The using unit must make every effort to pick up their repaired equipment promptly. Any special packaging, preservation, transportation, and shipping requirements are addressed during this phase.

b. Preventive Maintenance Checks and Services

Preventive maintenance checks and services is a systematic program consisting of inspecting, cleaning, servicing, lubricating, and adjusting. This program is the key to maintaining equipment readiness because it helps prevent early breakdown or failure of equipment. An effective PMCS program also reduces the number of costly, complex, and time-consuming repairs and allows the optimum use of maintenance resources through early detection of defects. The unit owning or using the equipment is responsible for scheduling and ensuring the completion of equipment PMCS. Preventive maintenance checks and services are normally a function of first and second echelon organizational maintenance.

(1) First Echelon PMCS. The operator or crew will perform a scheduled PMCS when it is within their authorized echelon of maintenance. There are certain items that, due to technological advances, use different criteria for scheduling preventive maintenance checks and services. An equipment's technical publication is the basic guide for performing preventive maintenance checks and services. Operators are primarily responsible for daily and monthly preventive maintenance checks and services.

(a) Daily PMCS. Operators or the crew perform daily PMCS every day that the equipment is operated. Equipment operated infrequently or intermittently normally does not require daily PMCS. Daily preventive maintenance checks and services are divided into before, during, and after operation services.

Before operation, preventive maintenance checks and services are performed on equipment to determine if the equipment is operational. A wide range of events can occur between service checks; for example, physical damage from handling; corrosion of electrical connections; or leakage of lubricants, coolants, operating fluids and gases. If equipment is found to be unserviceable or to require corrective maintenance, personnel must promptly report the deficiency so that the appropriate maintenance action can be taken.

During operation, the operator or crew must be alert to any unusual noises, odors, abnormal instrument readings, or any other irregularities that might indicate equipment malfunction. Every operation must be considered a test, and all unusual or unsatisfactory performance must be noted. When equipment is not operating, all deficiencies noted during operation must be investigated and corrected or reported.

After operation, preventive maintenance checks and services are performed to ensure equipment is ready to operate for the next mission. The operator or crew inspects the equipment thoroughly to detect any deficiencies that may have developed during operation. Assemblies requiring inspection or service while still at operating temperature must be inspected as soon as possible after equipment operation has ceased. All defects and irregularities that occur during operation must be corrected or reported to the echelon that can take corrective action.

(b) Monthly PMCS. Monthly PMCS reinforces daily preventive maintenance checks and services. Generally, it consists of the same checks performed during the daily PMCS, but in greater depth. For example, daily PMCS may require the operator to simply check the emergency brake for operation, but monthly PMCS may require cleaning and lubrication of the brake's moving parts. Management can also use monthly PMCS to evaluate a operator's daily PMCS performance. As with all preventive maintenance checks and services, supervision and inspection by qualified supervisory personnel should be stressed.

(2) Second Echelon PMCS. The owning or using unit schedules second echelon PMCS. Organizational maintenance mechanics are responsible for the performance of second echelon PMCS. Therefore, there must be constant coordination between the maintenance facility and the owning or using unit for the performance of second echelon PMCS. If feasible, the operator or crew should assist mechanics with the performance of their equipment's second echelon PMCS. This involvement helps operators gain a better working

knowledge of their equipment and increases maintenance productivity.

If a unit is operating under adverse climatic or terrain conditions, commanders are authorized to conduct second echelon PMCS actions more frequently than scheduled. Preventive maintenance checks and services may also be deferred or intervals extended if equipment is placed in an administrative storage program or equipment is placed on administrative deadline (see MCO P4790.2 for specific criteria). There are certain items that, due to technological advances, use different criteria for scheduling second echelon PMCS (see the appropriate technical publication for preventive maintenance checks and services requirements). The different classifications of second echelon PMCS are discussed below.

(a) Quarterly PMCS. The normal interval between quarterly PMCS is 3 months. Economy of operation demands that, within sound practices of safety and reliability, maximum useful life is obtained from materiel resources. Worn parts and materials are replaced during preventive maintenance checks and services.

Note: The life expectancy of the part/material and the nature of the anticipated operations must be taken into consideration.

When possible, the operator or crew of the equipment should be asked by maintenance personnel to obtain first-hand information on irregularities or indications of equipment malfunctions.

(b) Semiannual PMCS. The normal interval for semiannual PMCS is 6 months. Equipment technical publications provide the requirements for semiannual PMCS and other less frequent preventive maintenance checks and services. Economy of operation demands that, within sound practices of safety and reliability, maintenance personnel extract the maximum useful life from materiel resources. Worn parts and materials are replaced during preventive maintenance checks and services only when it is determined, after considering life expectancy and the nature of anticipated operations, that they cannot be expected to provide safe, reliable service until the next scheduled preventive maintenance checks and services. The operator or crew of the equipment should provide maintenance personnel with first-hand information on irregularities or indications of equipment malfunction.

(c) Annual PMCS. The normal interval for annual PMCS is 12 months, but it may be advanced when the operating criteria specified in equipment technical publications are achieved earlier. Equipment technical publications provide the requirements for annual PMCS and other less frequent preventive maintenance checks and services. Annual PMCS is greater in scope than semiannual PMCS and additional time is required to accomplish annual PMCS requirements. The operator or crew of the equipment should provide maintenance personnel with firsthand information on irregularities or indications of equipment malfunction.

(d) Biennial PMCS. The normal interval for biennial PMCS is 24 months, but it may be advanced when the operating criteria specified in the equipment's technical publications are achieved earlier. Equipment technical publications provide the requirements for biennial PMCS and other less frequent preventive maintenance checks and services. Biennial PMCS is greater in scope than annual PMCS and additional time is required to accomplish the maintenance requirements.

(e) Special PMCS. Special PMCS procedures are necessary when equipment has been exposed to harsh environments (e.g., salt water, fresh water, operations conducted in loose sand or mud). Equipment exposed to harsh conditions should be checked thoroughly for contamination, washed thoroughly with fresh water, and have appropriate services performed per the applicable technical publication/instruction. In most instances, a special PMCS will resemble a semiannual, annual, or biennial service. The commander may authorize the modification of the PMCS schedule to reflect the preventive maintenance checks and services performed and reschedule existing preventive maintenance checks and services.

c. Corrective Maintenance

Corrective maintenance actions are performed to restore a defective item to a specified condition. The detection of defective equipment may occur during routine preventive maintenance checks and services or through operational failure of the equipment. Corrective maintenance is a very time-consuming process and therefore requires close coordination of the maintenance workload and available resources.

If a required piece of equipment is unusable due to a failed part, then the equipment must be repaired. However, since corrective maintenance is very time consuming, the urgency of repair is relative to the unit's mission. To repair equipment that requires an echelon of maintenance higher than that authorized at the owning/using unit, it must be evacuated to the support activity authorized to perform the maintenance. Excessive delays in evacuation postpone corrective action and therefore must be avoided.

There are three basic stages of corrective maintenance.

(1) Isolating Equipment Malfunctions. During this stage, maintenance personnel attempt to isolate the equipment's malfunction so that corrective action can begin. Personnel use the appropriate support equipment; test, measurement, and diagnostic equipment; and the proper step-by-step procedures described in the applicable technical publication to isolate the cause of equipment malfunctions. Once the cause is isolated and fault diagnosis confirmed, personnel estimate the cost of the required maintenance and determine if the equipment is economically repairable. If the equipment is determined not to be economically reparable, personnel stop active maintenance, and request disposition instructions.

(2) Obtaining Required Repair Parts. The requisition of repair parts must be accurate to ensure the receipt of intended items in a timely manner. Inaccurate requisition procedures (i.e., using outdated publications and improperly completed forms) result in receipt of unneeded repair parts, delays in maintenance production, and wasted maintenance funds. Pre-expended bin levels, when used, should be maintained within each shop to ensure that selected items are readily available.

(3) Correcting Equipment Faults. Fault correction is the goal of all corrective maintenance actions. Proper maintenance techniques are employed to ensure that repair parts are installed correctly. Reassembly is accomplished in sequence, including the proper servicing and the use of test and measurement devices at the appropriate stages of equipment reassembly. Major completed maintenance actions are recorded on the ERO, this provides information for future management decisions and appropriate entries on equipment records.

d. Modification

Equipment modifications are maintenance actions performed to change the configuration of equipment systems, end items, components, assemblies, subassemblies, or parts to improve equipment functioning, maintainability, reliability, and/or safety characteristics. Primary sources of modification requirements are manufacturer's engineering change proposals and comments and suggestions made by using units via the Product Quality Deficiency Report. Complaints regarding equipment malfunction or poor design should be channeled to agencies responsible for procurement/development of Marine Corps equipment.

(1) Modification Responsibility. It is the responsibility of the using unit to determine which modifications have been issued for their assigned equipment and to take the necessary action for compliance. The modification instruction identifies the resources, skills (to include echelon of maintenance), and time necessary to perform the modification. If the application is to be applied by the unit, it is scheduled and performed at that level. For higher echelon modifications, the using unit must arrange to evacuate the equipment to the appropriate echelon of maintenance.

(2) Modification Control. Equipment modifications must be controlled to ensure safe equipment

operations. TM 4700-15/1 outlines unit responsibilities in establishing a modification control program. It also provides instructions for the completion and disposition of the records maintained by the unit. The maintenance management officer prepares periodic unit modification control program reports for the commander. There are two classifications of modifications: normal and urgent.

Modifications classified as normal are usually completed during regular maintenance activities such as preventive or corrective maintenance services. Normal modifications comprise the majority of modifications and generally do not restrict the operation of the equipment. Typically, the unit has 1 year from the date of the modification instruction to complete the actions required by a normal modification.

Modifications classified as urgent (printed at the top of the modification instruction) are issued to prevent serious injury to personnel and/or major equipment damage. Urgent modification instructions specify a date that the actions must be completed by and dictate any restrictive operating conditions until the modification is completed. For example, an urgent modification instruction might be issued to correct a faulty condition concerning the 5-ton trucks' fuel tanks. A leaking fuel tank could result in serious injury to operators and transported troops/cargo. Based on this safety hazard, the modification instruction would state that the truck is not to be operated (deadlined) until corrective actions are completed.

e. Calibration

Calibration is the process of adjusting items so that they measure within a standard deviation. This applies to equipment submitted for repair; maintenance tools and equipment; and test, measurement, and diagnostic equipment. Test, measurement, and diagnostic items are identified with labels that classify their category of calibration. There are four categories of calibration:

(1) Calibrated. Calibrated applies to instruments with all ranges and functions tested and found within applicable tolerances.

(2) Special Calibration. Special calibration applies to instruments with only a portion of the ranges and functions tested and found within applicable tolerances. The calibration label indicates the limitations (e.g., clockwise).

(3) Inactive. Inactive applies to instruments that will not be used in the foreseeable future. Equipment is not allowed to be in an inactive status for more than 3 years at a time. If equipment is inactive for 3 years, the unit should re-evaluate the need for the equipment. If the equipment is still required, personnel request a new inactive label from the supporting calibration laboratory.

(4) Calibration Not Required. Calibration not required applies to instruments that are used to make measurements of a noncritical nature or for instructional purposes. However, some instructional equipment will require calibration or special calibration.

f. Fabrication

Fabrication is the process of constructing or manufacturing parts or components that are not available through the normal supply system. It should not be used to circumvent the normal supply system. Fabrication is primarily performed at the intermediate maintenance activity. However, units may find themselves in situations where it is necessary to perform fabrication. Fabrication is generally accepted when it is within the unit's authorized echelon of maintenance. Once a decision to fabricate an item is made, the unit must consider safety and installation requirements. Personnel safety and damage to equipment must be addressed. Fabricated items are intended to replace a like item, not create a new item. Fabricated items that change the performance of equipment or require changes in structure (e.g., drilling additional holes) are not authorized.

2004. Information

Maintenance information provides the basis for managing a unit's equipment maintenance program. Maintenance information is comprised of records, reports, and an automated information system. Proper upkeep and use of maintenance

information are invaluable tools for analyzing and evaluating maintenance performance. The maintenance performance analysis and evaluation are generally expressed in the form of equipment readiness.

a. Records

Preparing and maintaining records consumes both personnel and materiel resources. Therefore, records must be kept to the minimum consistent with required Marine Corps directives and publications. Commanders should ensure that records originating within the unit are not prepared and used in lieu of or in addition to those required by Marine Corps directives and publications. Maintenance records are classified as equipment, resource, and local records. TM 4700-15/1 contains instructions for the preparation, use, and disposition of the required forms and records for the operation and maintenance of Marine Corps ground equipment.

(1) Equipment Records. Equipment records are maintained for a specific item of equipment. Equipment records are an integral part of the equipment because they contain historical data concerning repairs performed, maintenance schedules (i.e., PMCS schedule), and modifications. To ensure this information is available to maintenance personnel, equipment records must accompany equipment when it is evacuated for maintenance, transferred, or temporarily loaned to another unit.

(2) Resource Records. Resource records document the unit's maintenance efforts (e.g., modifications, preventive maintenance checks and services, calibration). These records contain historical information and provide the basis for evaluation of past performance and planning for future efforts/requirements.

(3) Local Records. Local records are discouraged. Local records should not be initiated unless a definite requirement has been established and it has been determined that records required by higher headquarters will not satisfy the requirement.

b. Reports

Maintenance reports contain information that commanders use to determine policy, to plan, to establish controls, to evaluate operations and performances, and to prepare other reports. They are generally summarized and may be transmitted on a recurring, one time, or occasional basis. Maintenance reports fall into one of the following classifications that reflect who generated the request.

(1) Headquarters, Marine Corps Reports. Reports submitted to Headquarters, Marine Corps include maintenance reports required by both Marine Corps directives and other forms of communication. They may be produced by either manual or automated means and normally contain a report control symbol. Reports currently required on a recurring basis are listed in the MCBul 5214 series, *Information on Requirements Management in the Marine Corps.* MIMMS is the primary source for maintenance reports required by Headquarters, Marine Corps.

(2) Field Reports. Field reports list a unit's special field requirements that Headquarters, Marine Corps reports do not address. Using these reports should be kept to a minimum so that units are not overburdened with administrative work. Whenever a requirement for a field-originated report is established on a recurring basis, it must be forwarded to the Commandant of the Marine Corps for nomination as a standard report.

(3) External Agency Reports. At times, a unit may be required to submit reports to an activity outside of the Marine Corps. Requests for reports considered invalid should be referred to the next senior unit in the administrative chain of command.

c. Automated Information Systems

Automated information systems were developed to assist the field user by automating manual administrative work. These systems provide commanders at all levels with excellent, up-to-date information and management tools. MIMMS is

the current automated system for the maintenance field and is discussed in appendix B.

Headquarters, Marine Corps (HQMC code LP) encourages the use of automated systems to capture, track, and schedule maintenance actions/information. As the system sponsor for all Class I supply and maintenance systems, Headquarters, Marine Corps (HQMC code LP) intends to integrate both maintenance and supply under a single system with the fielding of Asset Tracking Logistics and Supply System Phase II+.

d. Readiness Reporting

As prescribed in MCO 3000.11, *Marine Corps Ground Equipment Resource Reporting (MCGERR)*, commanders are required to report the level and condition of MCGERR-reportable equipment. Table 2-2 identifies categories of ground equipment readiness. MCGERR-reportable equipment is identified in MCBul 3000, *Table of Marine Corps Ground Equipment Resource Reporting (MCGERR) Equipment.* Equipment included in this bulletin must be a principal end item that is 85-percent fielded Marine Corps-wide (including the Reserves), nominated by either the field commands or Headquarters, Marine Corps, and accepted for inclusion (or deletion) by the Commandant of the Marine Corps (Logistics).

Note: The term "fielded Marine Corps-wide" means that the system's manager, in coordination with the project manager for the principal end items, has verified to the Commandant of the Marine Corps that sufficient quantities are distributed throughout the Fleet Marine Force and Reserves to meet the 85-percent criteria.

Readiness reporting for Marine Corps supplies and equipment has three components: mission-essential equipment, table of equipment deficiencies, and equipment deadlines.

(1) Mission-Essential Equipment. Mission-essential equipment is governed by MCBul 3000. This bulletin lists selected items of mission-essential equipment required to be reported to higher headquarters. The items that appear in this bulletin do not represent a complete list of equipment normally considered mission-essential at the battalion level; for example, M16A2 rifles are not included due to their high density. However, the list is sufficiently representative to provide an adequate measure of the equipment readiness of the operating forces.

(2) Table of Equipment Deficiencies. Table of equipment deficiencies are items that are authorized but not on-hand. To remain a force in readiness, the Marine Corps plans, programs, and budgets annually for the modernization of its equipment and capabilities. The modernization of mission-essential equipment could have a substantial effect on MCGERR reporting. Accordingly, a replacement item and the item it is replacing may be excluded from MCGERR reporting during the modernization (phase in/phase out) of equipment.

Table 2-2. Categories of Ground Equipment Readiness.

Category	Percentage of Mission-Essential Equipment That Is Operationally Ready
C-1	90-100
C-2	70-89
C-3	60-69
C-4	0-59

Notes:
1. MCBul 3000 lists mission-essential equipment and provides an adequate measure of the equipment readiness of the operating forces.
2. Per Joint Pub 1-02, operationally-ready equipment is "the status of an item of equipment in the possession of an operating unit that indicates it is capable of fulfilling its intended mission and in a system configuration that offers a high assurance of an effective, reliable, and safe performance."

(3) Equipment Deadlines. Equipment deadlines are items that are not capable of performing their designed combat missions due to their need for critical repairs. Ground equipment readiness reporting begins at maintenance shops with the determination of deadline status. Table 2-2 identifies categories of ground equipment readiness. Deadline status is entered into MIMMS at the maintenance shop level via the ERO input. Deadline status is normally determined by commodity managers/shop officers. However, final authority for determining whether or not a piece of equipment is capable of performing its assigned combat mission rests with the commander. Excessive delays in evacuation postpone corrective action and therefore must be avoided.

Chapter 3

Maintenance-Related Programs

"If field operations continue for a considerable length of time, it may be necessary to reinforce the cartridge belts, magazine carriers, and other web equipment with leather. This has been done in the past by local artisans in the theater of operations."[1]—FMFRP 12-15

The Marine Corps has implemented several maintenance-related logistic programs to assist commands with the management of their equipment maintenance. This chapter discusses some of the more important maintenance-related programs that commanders should be familiar with.

3001. Secondary Reparable Program

The Secondary Reparable Program is an effective means of maintaining a high state of equipment readiness. It provides a pool of serviceable assemblies, subassemblies, and component parts for rapid exchange of unserviceable like items (e.g., carburetors, starters, generators, radiators). These are also referred to as line replaceable units. Secondary Reparable Program item candidates are identified by the source, maintenance, and recoverability (SMR) codes in the SL-4, technical manuals, and parts manuals (see app. C).

Secondary Reparable Program items are positioned in floats maintained by the Supported Activities Supply System (SASSY) management unit, supply battalion, FSSG. Critical low density items are normally held by the owning unit. The SASSY management unit may also operate several subfloats and position them where they can provide immediate service to customers. The float holder issues a catalog that identifies the floats it manages. These floats allow units to minimize equipment down time by providing a one-for-one component exchange and eliminating the need for time-consuming supply requisitions. General steps included in the Secondary Reparable Program process are as follows.

a. Removal

The defective item is removed from the end item and taken to the supporting float by the owning or intermediate maintenance unit. Removal of any item is accompanied by turn-in documentation required by the float holder.

b. Turn-In

The defective item is checked for completeness and is exchanged for an on-hand, serviceable item. If an exchange item is not on-hand, the float holder accepts the defective item and provides the customer with a backorder receipt. Once the float holder receives the required item from its source, the item is issued to the customer. If several units have placed demands on the float holder for like items, the float holder issues the requested item based on the established priority of need. Priorities are assigned to all supply transactions in accordance with the guidelines contained in MCO 4400.16.

c. Repair

Defective items turned in to the float holder are sent to the maintenance battalion for repair and subsequent return to the float holder's stock.

3002. Replacement and Evacuation Program

The Replacement and Evacuation Program is another type of float maintained at the depot maintenance level to replace and repair worn out, selected major end items on a scheduled basis. The Replacement and Evacuation Program assures a requisite readiness level throughout the

Marine Corps by cyclically rebuilding items before they become unreparable. TI-4710-14/1, *Replacement and Evacuation Criteria, USMC Equipment*, lists the equipment administered by this program. It also contains specific criteria for selecting/nominating equipment for rebuilding.

a. Equipment Nomination

Organizations nominate equipment for rebuilding and replacing to the Commandant of the Marine Corps through the chain of command and the local Replacement and Evacuation Program coordinator, in the supporting FSSG. Nominations are made each year for the next 3 years. The Commandant then uses unit nominations and the workload of the depot maintenance activities to establish yearly allowances for Marine Forces. Marine Forces then allocate allowances to their major subordinate commands. Once allocations are physically made available, nominating units are authorized to turn in items to the force service support group and receive replacements.

b. Selection

When a unit is directed to turn in equipment for replacement and evacuation they must select the items that are in the worst condition, yet still repairable. Equipment that is not repairable does not qualify for the Replacement and Evacuation Program.

c. Equipment Exchange

When units turn in equipment they should ensure that all collateral (e.g., SL-3 gear) equipment required by higher headquarters accompanies the turn-in. Generally, a requirement exists for missing collateral equipment to be noted on the limited technical inspection of an item. The unit should indicate if responsibility for the loss is known or what action is ongoing to determine responsibility. Before accepting a replacement item, the unit should inspect and ensure that the item is in condition code A as defined in the applicable supply directives. If not, the unit should either refuse the item or note the deficiencies on the acceptance inspection sheet.

3003. Recoverable Item Program

Equipment not included in the Replacement and Evacuation Program is disposed through the Recoverable Item Program, also known as the WIR Program. This program is outlined in MCO P4400.82, *Marine Corps Unified Materiel Management System (MUMMS) Control Item Management Manual.* The WIR Program provides for the recovering, reporting, and managing of equipment that cannot be repaired within the resources of the field commander and for the disposal of items that are beyond economical repair. Commanders replace unserviceable items through the supply system.

3004. Corrosion Prevention and Control Program

Marine Corps tactical ground and ground support equipment are particularly susceptible to corrosion and other types of moisture damage due to their material composition and assigned missions in moisture-laden environments. Compounding the problem is the fact that a significant portion of Marine Corps ground equipment is stored outdoors without shelter and subject to the direct, corrosive effects of the environment. The Corrosion Prevention and Control Program was established to extend the useful life of Marine Corps tactical ground and ground support equipment. Its intent is to reduce maintenance requirements and associated costs through the identification, implementation, and development of corrosion prevention procedures and corrective corrosion control. The Corrosion Prevention and Control Program seeks ways to use technologies and processes that will repair existing corrosion damage and prevent, or retard, future corrosion damage to Marine Corps ground and ground support equipment. MCO 4790.18, *Corrosion Prevention and Control Program*, and TM-3080.12, *Corrosion Control G/Equipment*, address the Corrosion Prevention and Control Program in detail.

a. Preventive Corrosion Control

The Marine Corps corrosion prevention program starts at acquisition. Corrosion prevention focuses on identifying, developing, and implementing state-of-the-art technologies and processes that directly prevent the corrosion, not just its symptoms. If preventive corrosion measures are successful, then corrective maintenance resources are conserved and equipment service life is significantly extended.

b. Corrective Corrosion Control

Corrective corrosion control identifies, develops, and implements technologies and processes that correct current equipment deficiencies resulting from corrosion and moisture damage. The Marine Corps is currently experiencing severe corrosion problems resulting from the seaborn transit and saltwater immersion of equipment during amphibious exercises/operations and the indoor/outdoor storage of equipment in moisture-laden environments. Some of these corrosion problems are also the result of equipment design and manufacturing deficiencies that need to be identified and addressed.

3005. Joint Oil Analysis Program

The Joint Oil Analysis Program is an agreement among the Navy, Army, and Air Force. It standardizes policies, procedures, research, and development for the process of oil analysis. Oil analysis is a general term that describes scientific tests and evaluations performed on used oil.

The Marine Corps is an associate member of the Joint Oil Analysis Program coordinating group. This group implements and monitors the oil analysis program. Their analysis determines whether oil may be retained or must be changed, and it also provides information on the internal condition of engines, transmissions, and other oil-wetted components. The Joint Oil Analysis Program has two components: spectrometric analysis and physical property analysis.

a. Spectrometric Analysis

Spectrometric analysis is used to determine the concentrations of various wear metals in oil samples. Wear metals are metal particles of microscopic size that enter the oil stream and are dispersed and suspended throughout the lubricating system. These particles are produced by the friction of moving parts within a mechanical system. Analysis of the oil for the wear metal type and amount determines which component parts may have generated the particles. Periodic sampling and testing of oil from a mechanical system helps to detect abnormal component wear and assist in the maintenance effort.

b. Physical Property Analysis

Physical property analysis detects property changes in used oil. Changes in viscosity, fuel dilution, or water content may indicate faulty equipment, operating conditions, or maintenance procedures. Physical property analysis is instrumental in eliminating the wasteful requirement of changing oil based on hours/miles/calendar days as currently specified by some technical publications and lubrication orders.

c. Sampling Procedures

General sampling procedures and techniques are discussed in MCO 4731.1, *The U.S. Marine Corps Oil Analysis Program.*

Chapter 4

Maintenance Organizations

"There is no area of military activity where so many departures from the theoretical ideal are required by circumstances as in organization. Yet the fact that compromises which produce defects are inevitable should not lead us to ignore them. Instead we have the task of recognition and compensation."[1]—FMFRP 12-14

Task organization is a quantitative and qualitative process used to best structure available assets to support a specific mission and concept of operations. It is applicable whether commanders are building combat power or maintenance capability. Within this context, the CSSE is the Marine air-ground task force (MAGTF) element that provides the task-organized intermediate ground maintenance capability to support requirements beyond the organic capabilities of the supported elements. Combat service support elements vary in size from temporary, task-organized combat service support detachments (CSSD) to permanent organizations such as the FSSG. Normally, there is only one combat service support element in a MAGTF.

4001. Types of MAGTF Combat Service Support Elements

The designation, size, and composition of the MAGTF combat service support element is determined by the mission, size, and composition of the MAGTF it supports. There are five basic types of combat service support elements.

a. Force Service Support Group

The FSSG is a permanently structured command. Its mission is to provide combat service support to the Marine expeditionary force. The FSSG normally has eight permanent battalions, but task organizations can be created from these battalions to support Marine expeditionary force operations over a large geographic area. The FSSG is the Marine expeditionary force's combat service support element. It supports the Marine expeditionary force command element; surveillance, reconnaissance, and intelligence group; ground combat element comprised of one Marine division; and aviation combat element comprised of one Marine aircraft wing.

b. Combat Service Support Group

The combat service support group is the task-organized combat service support element of a unit with less than the full spectrum of capability normally afforded a Marine expeditionary force. For example, a combat service support group currently supports Marine units stationed in Hawaii. Personnel and equipment are assigned to the combat service support group from permanent battalions of the FSSG. This support group provides general and direct combat service support to designated units. If required, it may be augmented by assets from the division and/or wing.

c. Marine Expeditionary Unit Service Support Group

The MEU service support group (MSSG) is a task-organized combat service support element that provides combat service support to all elements of the Marine expeditionary unit. Like the combat service support group, the MEU service support group draws its personnel and equipment from the organic battalions of the FSSG. The MSSG may also contain assets from the division and/or the wing.

d. Combat Service Support Detachment

A combat service support detachment is usually task-organized from numerous sources. Its primary tasks are to rearm, refuel, and provide limited maintenance repair/supply for a supported unit. Combat service support detachments are created and task-organized to meet a combat service support mission. For example, a CSSD can support a regiment, another CSSD may provide direct support to a battalion conducting independent operations, and yet another CSSD may support an aircraft squadron operating at a remote airfield. Combat service support detachments can also be designated as mobile CSSDs. A mobile combat service support detachment, as the name implies, possesses sufficient mobility assets to keep pace with and respond to a supported maneuver element. Its capabilities usually mirror the parent combat service support detachment, but on a reduced scale.

e. Landing Force Support Party

The landing force support party is a temporary organization that provides interim combat service support capability until the CSSE is phased ashore. Its mission is to support the landing and movement of troops, equipment, and supplies across the beaches and into helicopter landing zones. The nucleus for this task organization is the landing support battalion, FSSG. The organization and mission of the landing force dictate the structure of the landing force support party. Naval elements may include detachments from the cargo handling and port group and the beachmaster unit. The landing force support party is normally dissolved and absorbed by the CSSE once it is ashore and established.

4002. Combat Service Support Installations

Operational logistic installations are the source of most combat service support for the MAGTF. These installations are physical locations either aboard ship or ashore. The number, location, and specific capabilities of combat service support installations are based on the MAGTF's mission, concept of operations, and combat service support concept. The MAGTF's concept of operations must address the requirement to defend and protect these installations and facilities. The major types of combat service support installations are as follows.

a. Force Combat Service Support Area

At the Marine expeditionary force level, the CSSE establishes a force combat service support area (FCSSA) in close proximity to a beach, seaport, and/or an airfield. From this location, the force combat service support area supports other CSS installations and provides greater support capabilities to the MAGTF than those available at forward installations. All six functional areas of combat service support, or any combination thereof, is resident within the FCSSA to include dumps and issue points for rations, fuel, ammunition, and water. Combat service support element commanders generally divide their recovery assets between the force combat service support area and the combat service support area to achieve a balance between economy and responsiveness.

b. Combat Service Support Area

The combat service support area (CSSA) is a forward support installation. It is designed to extend the reach of the force combat service support area. The combat service support area funnels combat service support onward to forward supported elements or their CSSDs. It does not have the full spectrum of combat service support capabilities found in the forward combat service support area. The CSSA provides the minimum essential support required in the six functional areas of combat service support. Its composition (e.g., dumps, issue points) is determined by the CSSE commander based upon the MAGTF concept of operations. The combat service support area is supported by the force combat service support area.

c. Beach Support Area

The beach support area is normally one of the first combat service support installations established ashore during an amphibious operation.

Established by the landing force support party to facilitate initial throughput requirements, the beach support area may expand to include the full spectrum of combat service support functions or it may be designated as a CSSA. Also, it may eventually be dissolved or become the force combat service support area. In some situations, the beach support area may be the only combat service support installation ashore. In other situations, it may be one of several combat service support installations. The CSSE commander determines the beach support area's composition (e.g., dumps, issue points, etc.) based on the MAGTF concept of operations.

d. Landing Zone Support Area

The landing zone support area (LZSA) is a combat service support area established to support helicopterborne operations. It is normally developed from an existing helicopter landing zone that was established by a helicopter support team. A helicopter landing zone is established when a combat service support buildup beyond the helicopterborne unit's basic load of supplies and ammunition or organic CSS capabilities is required. When a combat service support buildup begins in a helicopter landing zone, control of the helicopter landing zone normally transitions from the helicopterborne unit's helicopter support team to a designated combat service support unit and the helicopter landing zone is redesignated an LZSA. Although the landing zone support area can be expanded into a CSSA, it is most often a short-term installation with limited capabilities. Typically, an LZSA only contains dumps for rations, fuel, ammunition, and water.

e. Repair and Replenishment Point

A CSSD normally establishes a temporary repair and replenishment point to support mechanized or rapidly moving units. Repair and replenishment points are either a pre-established point or a hastily selected point to rearm, refuel, or provide repair services to the supported unit. Depending on the mission, a combat service support detachment may establish multiple repair and replenishment points. Although the main body of the CSSD usually follows the advancing unit, repair and replenishment points are normally located in forward areas near the supported unit's trains. To minimize the handling of supplies, vehicles from a combat service support area deliver directly to the users at the forward repair and replenishment points.

4003. Permanent Organizations

Permanent organizations are established with tables of organization and tables of equipment. Each unit's table of organization establishes its structure and mission. Its table of equipment establishes the quantity and type of authorized equipment required to perform the unit's assigned mission. By table of organization and table of equipment, 11 MAGTF units of battalion and squadron size or larger possess organic maintenance capabilities. There are two permanent combat service support organizations within the Marine expeditionary force that provide intermediate ground maintenance support to the MAGTF: the force service support group and the Marine wing support group. These organizations possess most of the assets required to task-organize the combat service support element. Normally, the FSSG is the primary source of intermediate maintenance support for the ground combat element.

a. Maintenance Battalion, FSSG

(1) Mission. The maintenance battalion provides intermediate (third and fourth echelon) maintenance for Marine Corps-furnished tactical ground equipment of a Marine expeditionary force.

(2) Concept of Employment. The battalion establishes and operates intermediate level, direct and general support maintenance facilities in support of the Marine expeditionary force or any smaller combination of MAGTF. If the maintenance battalion is supporting MAGTFs smaller than a Marine expeditionary force, it forms platoon detachments from each of the functional companies (while maintaining unit integrity) assigned to the supporting combat service support element. The detachments are task-organized to provide all second and third echelon and limited

fourth echelon secondary reparables capabilities. Maintenance support of major end items is provided by maintenance support teams whenever possible.

(3) Organization. Maintenance battalion, FSSG is organized with a headquarters, support elements, four commodity maintenance companies, and a general support maintenance company (see fig. 4-1). It is staffed and equipped to be employed in two modes simultaneously. First, with task-organized detachments and maintenance support teams that provide CSSE support and on-site repairs for supported units. Second, as a functional commodity area company that operates a centralized maintenance facility.

The battalion is effective when it is employed in a centralized manner and co-located with its sources of supply or as task-organized detachments/ maintenance support teams. The method of employment (centralized, task-organized, or a combination of the two) is situationally driven to provide the most effective means of support based on mission requirements and available resources.

(4) Maintenance Companies. The battalion's five maintenance companies differ not only in the kind of equipment they repair but also in the level and type of repairs they can perform. Engineer, motor transport, and ordnance maintenance companies are the most mobile and perform maintenance on their respective types of equipment by replacing end item parts or components. The electronics maintenance, ordnance, and general support maintenance companies also repair their own components, but their work generally requires more sophisticated tools and test equipment and environmentally-controlled work areas making them the least mobile of the battalion's units.

The electronics maintenance company's main emphasis is the repair of secondary reparables and their subsequent return to float stockage. Little maintenance is performed to end items. The secondary responsibility of the electronics maintenance company is the calibration and repair of test equipment for all commodity areas. Therefore, the employment of the company and its detachments may be different than the employment of the other commodity areas. The electronics maintenance company commander is responsible to the commander for dispersing assets to cover the numerous floats spread out in support of the combat elements while still maintaining sufficient equipment (primarily test equipment) to provide timely repairs for all floats. For example, the commander may attach small detachments to a float for the repair of most communications and electronics equipment and establish evacuation procedures to send difficult or time consuming repairs to the rear.

b. Marine Wing Support Group and Marine Wing Support Squadron

The Marine wing support group is limited to first echelon maintenance. The Marine wing support squadron is authorized first and second echelon maintenance on ground equipment and some third and fourth echelon maintenance on expeditionary airfield-related equipment. If requirements exceed this capability, the maintenance battalion of the FSSG provides intermediate support.

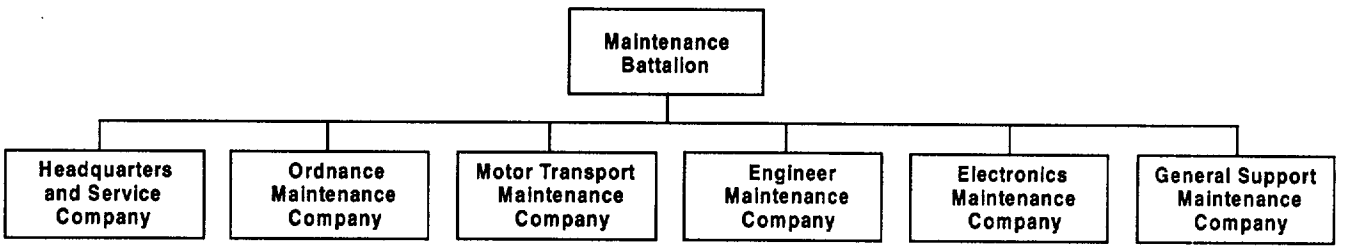

Figure 4-1. Maintenance Battalion, FSSG.

4004. Mobile Maintenance Teams

The mission of maintenance teams is to diagnose problems, route repairs, and replace combat unit equipment as far forward as possible on the battlefield. There are two types of maintenance teams: maintenance contact teams and maintenance support teams. Maintenance contact teams come from the organizational maintenance activity of the equipment owner and are located close to combat units. Maintenance support teams come from the CSSE and perform their duties at forward sites. The situation determines the composition of the mobile maintenance team (manpower and equipment). Therefore, maintenance teams are task-organized to fit the particular maintenance effort required.

a. Maintenance Contact Team

The maintenance contact team is a key element of organizational maintenance. The maintenance contact team has organizational maintenance repairmen with tools, test equipment, technical publications, and limited repair parts. The maintenance contact team may have communications, engineer, motor transport, or ordnance repair personnel depending on the table of equipment. The unit commander determines the exact number of personnel and mix of skills in the maintenance contact team.

b. Maintenance Support Team

The CSSE commander may form maintenance support teams from available assets. The CSSE commander determines the task organization of the maintenance support team. At a minimum, the maintenance support team contains intermediate level maintenance (i.e., engineer, motor transport, ordnance, or communications-electronic), special tools, and transportation as required. The CSSE commander uses maintenance support teams to support either organizational maintenance contact teams within the MAGTF or to augment subordinate combat service support detachment capabilities during surge periods.

4005. Central Maintenance Shops

The organization of unit maintenance activities, personnel, and equipment into a central maintenance shop, if compatible with the unit's mission, is normally preferred over distribution throughout equipment operating elements. Central maintenance shops increase economy of operation, decrease time required for maintenance, and improve maintenance quality. Although a maintenance shop's organization will vary, most shops consist of a shop office/operations section, administrative section, services section, maintenance section, and an issue point as shown in figure 4-2. The issue point may be internal or external to the shop or it may be a central issue point serving a major command or geographical location.

a. Shop Office/Operations Section

A shop office manages the overall conduct of maintenance within the shop. This includes, but is not limited to—

- Recommending personnel assignment.
- Scheduling maintenance.

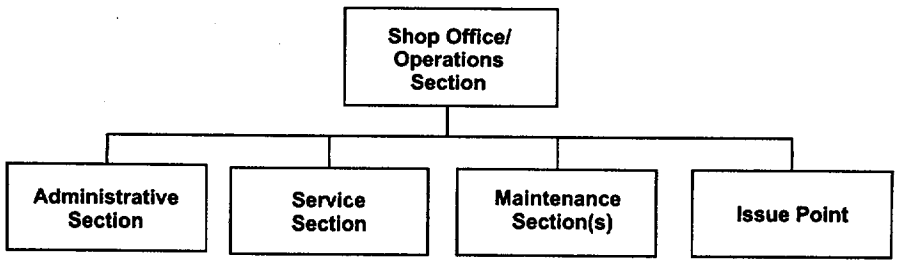

Figure 4-2. Central Shop Organization.

- Ensuring that maintenance operations interface with maintenance-related programs.
- Ensuring the economic use of maintenance resources.
- Supervising maintenance training within the shop.
- Ensuring that proper transactions are submitted into the Field Maintenance Subsystem for maintenance actions completed and changes in ERO status.

b. Administrative Section

The administrative section performs functions associated with equipment receipt and transfer, technical data research, tool issue, shop property control, and the recording and reporting of completed maintenance actions within the shop. An administrative section can range from one person in small shops to several people in larger shops.

c. Services Section

A services section performs functions in support of equipment maintenance; for example, welding, battery shop service, inspection, quality control.

d. Maintenance Sections

The actual performance of maintenance is accomplished by maintenance sections. These sections may be organized in a number of different ways:

- By function (e.g., preventive maintenance checks and services, corrective maintenance, modification).
- By equipment (e.g., light, medium, heavy, or specific equipment type).
- By commodity (e.g., motor transport, ordnance, engineer, ground maintenance equipment).
- By echelon (e.g., second, third, fourth, or even second and third).

Chapter 5

Maintenance Planning

"The factors and methods which give great economy in a stable situation may not be adequate for the changing situation."[1]—FMFRP 12-14

". . . Mere size is no suitable object; rather, the efficiency of the logistic support rendered is the true aim."[2]—FMFRP 12-14

MCDP 4 shows that common to all logistic systems are a distribution system and command and control. The distribution system is made up of bases (sources sized and located in accordance with need and capability) and distribution procedures (means, parameters, and criteria to distribute). Command and control provides the ability to administer, monitor, and adjust the distribution system as required. Therefore, planning efforts must focus on developing a distribution system with the command and control appropriate to the mission and scheme of maneuver.

Planning expeditionary maintenance to support MAGTF operations must start early and be adjusted, as necessary, with the receipt of the initiating directives and other planning documents. Both the supported and supporting units must know each other's responsibilities if a unit commander is to receive timely and appropriate combat service support. While maintenance and supply are separate functions, maintenance support planning must parallel and interface with supply planning efforts. It is also essential to make maximum use of the FSSG's major base/installation facilities to prepare equipment prior to deployment.

5001. Supported Unit Responsibilities

Supported unit commanders, through the coordinated efforts of the G-3s/S-3s and G-4s/S-4s, initiate combat service support detailed planning. Combat service support planning begins by determining support requirements, assigning priorities, and allocating resources.

a. Determining Support Requirements

Supported unit commanders must determine and identify combat service support mission requirements that are beyond their organic capabilities. To accurately determine the type and amount of external service support, the supported commander's staff must calculate the exact quantities of needed supply categories. The following factors should be considered when calculating need:

- MAGTF mission.
- Characteristics of the objective area, including available resources, climate, weather, and terrain.
- Enemy capabilities.
- Characteristics of operations to be supported.
- Duration of the operation.
- Capability and dependability of the transportation system (outside and inside the objective area).
- Tasks requiring special supplies and equipment.
- Experience in similar operations.

b. Assigning Priorities

Units assign priorities based on their assigned force activity designator (FAD) and urgency of

need designators as outlined in MCO 4400.16. Units upgrade force activity designators based on changes to the unit's mission. Commanders must be keenly aware of their FAD and when it changes. A unit's FAD directly translates to whose equipment is fixed first. The assignment of priorities affects the supporting CSSE's concept of combat service support and must be coordinated by the supported unit and the combat service support element to ensure that adequate combat service support is available during the early stages of an operation. Ultimately, the MAGTF commander oversees assignment of priorities.

c. Allocating Resources

Supported unit commanders allocate available organic CSS resources, including the assets they retain as a reserve, to subordinate elements within their organization. These allocations must support and complement the MAGTF's concept of operations and reflect previous decisions concerning requirements and priorities. Like supported unit commanders' assignment of priorities, their allocation of combat service support resources also affects the supporting CSSE's concept of combat service support.

5002. Supporting Unit Combat Service Support Responsibilities

The supporting combat service support planner can be an important asset to the supported unit. The supporting combat service support planner can advise and assist the unit in refining requirements, procuring the resources to meet those requirements, and planning for the distribution of assets to support the mission and concept of operations.

a. Determining Requirements

Requirements are based on the supported commanders concept of operations and the situation. The identified requirements must address each CSS functional support area. The CSSE must know the requirements early in the planning phase and be informed of changes as they occur. Close coordination between the supporting CSSE and the supported unit prevents support shortfalls.

b. Procuring Assets

The supporting combat service support element procures assets based on the requirements needed to sustain the supported unit. To prevent unnecessary logistical burdens, the CSSE planner carefully reviews requirements to avoid overestimating requirements.

c. Distributing Assets

The distribution of assets is the actual performance of the supported service. The distribution of assets has the most critical impact on responsiveness, flexibility, and economy of combat service support. Assets distribution can be successfully achieved only by coordinated predeployment planning, which anticipates and provides for unexpected replenishment opportunities, surge requirements, and alternate delivery means.

5003. Combat Service Support Planning References

a. Table of Authorized Materiel

The table of authorized materiel (TAM) provides general information and instruction on the supply system; specific information on classes I, II, III, IV, and VII; and replacement factors needed to project anticipated losses or consumption rates. This source document is the one most used by Marine Corps personnel with regards to logistic planning.

b. Mechanized Allowance List and Table of Equipment

The mechanized allowance list (MAL) and table of equipment (T/E) identify the equipment that a unit rates and the total of what it has on-hand or on order. The table of equipment is primarily

concerned with class VII items. It also assists in the determination of class V because it identifies the number and type of weapon systems a unit possesses. The table of equipment listing of vehicles/equipment is also very helpful in determining class III and IX requirements.

c. Table of Organization

The table of organization (T/O) contains the organization of the unit and a listing of the unit's authorized personnel allocations. The table of organization is useful to the logistic planner because it describes the logistic capabilities of the unit and assists in the determination of classes I, II, V, and VII.

d. Marine Corps Orders

MCO 8010.1, *Class V(W) Supply FMF Combat Operations*, provides class V(W) supply rates during combat operations. MCO P8011.4, *Table of Allowances for Class V(W) Materiel (Peacetime)*, provides information for determining training requirements.

e. Marine Corps Doctrine

Marine Corps doctrine portrayed in the 4 series of our doctrinal hierarchy includes doctrinal publications (MCDP 4, *Logistics*) future warfighting publications (MCWP 4-1, *Logistics Operations* [under development]), and reference publications (FMFRP 4-34, *Recovery and Battlefield Damage Assessment and Repair*). This doctrine is invaluable to understanding the nature of logistics as it applies to our warfighting philosophy. It provides the framework for applying the necessary tactics, techniques, and procedures. A thorough grounding in our warfighting doctrine is essential to effective planning.

f. U.S. Army Field Manual

FM 101-10-1/2, *Staff Officers' Field Manual: Organizational, Technical, and Logistical Data* (volume 2), provides planning factors for engineer, supply, transportation and movement, personnel services, health services, and operational force requirements.

5004. Personnel Considerations

Maintenance planning must include every level of mechanic and technician needed to support MAGTF ground equipment. The ratio of mechanics to the density of equipment to be supported must be considered during planning. This planning includes the organizational maintenance mechanics of MAGTF units and the CSSE's intermediate maintenance mechanics. The composition of maintenance contact teams and maintenance support teams must also be programmed to support the MAGTF's scheme of maneuver.

5005. Maintenance Tools Considerations

The need for special and general tools and kits must be considered during MAGTF maintenance support planning. The following factors determine the need for special and general tools kits:

- Types of equipment to be supported.
- Density of equipment supported.
- Mobility required.
- Environmental conditions.

5006. Safety Considerations

All commanders must address the safety of personnel during expeditionary maintenance operations. Personnel safety must be a primary concern. Lack of effective safety measures can result in tragedy. The following safety issues should be addressed at all levels of command during the planning phase and while operations are underway:

- Are personnel properly trained for the tasks and procedures they are performing?
- Is the operation adequately staffed and supervised by personnel qualified in their position?

- Has the operational tempo increased to the point where haste, fatigue, and personnel availability are causing common safety practices, procedures, and regulations to be violated?

5007. Maintenance and Supply Interface

The supply system provides the MAGTF with the material it needs to support unit operations. The needs of the supported unit must be the basis of all supply efforts, especially that of the CSSE. The using unit level is where the supply cycle begins and ends. Therefore, supply related limitations that affect maintenance support operations must be minimized. Tailoring repair parts blocks to support a MAGTF's maintenance effort, collocating issue points and maintenance facilities, warehousing to support anticipated maintenance, and using maintenance and supply automated information systems are all part of the maintenance and supply interface. The goal is to provide the using unit with sufficient expeditionary maintenance capabilities to support the scheme of maneuver without overtaxing embarkation/lift constraints.

a. Repair Parts Block (Class IX Block) Composition

During the predeployment phase, a class IX block is tailored to support MAGTF units. The process of estimating the supply block begins with the SASSY Management Unit running a deployment support generator package (also known as a genpack.) This automated computer program estimates repair parts requirements based on historic usage data (past demand for parts in support of equipment by identification number). The SASSY Management Unit runs the genpack against the equipment density list provided by the MAGTF to estimate repair parts requirements for each type of equipment supported. Since this history does not capture variable that influenced the demand (e.g., operating climates), the estimates usefulness is mainly as a starting point to further develop and refine the class IX block. To further refine the estimate, commanders also consider the experience captured in lessons learned from previous operations and the input provided by their maintenance personnel. The following factors should be considered during repair parts block determination:

- Type and density of equipment to be supported.
- Level of maintenance to be performed by the organizational and CSSE maintenance elements.
- MAGTF objective and scheme of maneuver.
- Environmental impact.
- Projected length of operation and resupply capability.
- Other resources in the MAGTF's area of operation.
- After-action reports of MAGTFs previously deployed to the same region.
- High demand national stock numbers.
- Embarkation and lift constraints.

b. Repair Parts Issue Point

Ideally, the CSSE commander locates the repair parts issue point near the intermediate maintenance area. At each forward issue point, the combat service support detachment maintains a block of repair parts tailored to the anticipated needs of the supported unit(s).

Note: The repair parts block, which the combat service support detachment holds, has limited range and depth (too large a supply block limits mobility, too small a supply block reduces responsiveness).

The preponderance of class IX blocks arrive in the area of responsibility with the assault follow-on echelon. When they arrive, the combat service support element expands the primary issue point in the force combat service support area.

Forward issue points stock only those class IX repair parts necessary to maintain combat-essential equipment. The MAGTF commander establishes

the stockage objective for forward issue points based on the CSSE commander's recommendation. The composition of the issue point is determined by the MAGTF scheme of maneuver and the supported unit's type and density of equipment.

c. Warehousing Parts

The warehousing of parts must be considered during supply support planning. Warehousing of parts is the process of packaging parts in a priority of issue sequence. The anticipated order of issue determines the packaging process (i.e., the first parts to be issued will be the last to be packaged so they can be readily accessed). The ability to identify, locate, and access required parts in a timely manner is critical to the maintenance effort's supply support. The MAGTF's automated information systems allow supply functions to be responsive to the maintenance support effort.

Note: Consideration also must be given to the usage of parts blocks afloat during the movement phase of an operation. The ability to access required parts in support of the maintenance effort aboard ship must be coordinated with ship personnel prior to deployment.

d. Information Systems Support

Within the MAGTF, commanders down to the battalion and company level have organic, automated information systems to manage their manpower, supply, maintenance, embarkation, and disbursing. Both MIMMS and SASSY provide the MAGTF commander with timely and accurate information concerning the status of equipment undergoing repair and the repair parts required to effect those repairs. The interface between MIMMS and SASSY must take place in the mainframe located in the continental United States. Planning for deployed maintenance reporting must include a description of available transmission mediums such as a message editing processing system, electronic mail system, and satellite communications. (See app. B for further information concerning information systems.)

Chapter 6

Maintenance Execution

"Has all the money spent on what is now called 'the tail' been wasted?"[1]—FMFRP 12-14

The Marine Corps demands that its maintenance plan is well directed, organized, staffed with sufficient materiel and trained personnel, and executed with its focus on the supported units mission and the commander's intent. Chapter 6 addresses the impact of maintenance execution in the organization, embarkation, transit, offload, and employment of personnel and materiels.

6001. Ground Maintenance Control and Execution Options

Commanders may centralize or decentralize control and execution of their maintenance operations. For example, during an amphibious assault, the landing force support party has limited maintenance capabilities. The landing force support party commander normally centralizes both control and execution of maintenance operations at the beach support area or landing zone support area. Once the CSSE comes ashore, maintenance capabilities increase. This permits a shift to centralized control and decentralized execution of certain maintenance tasks.

Note: Some maintenance tasks are always centralized because the CSSE has limited resources.

MCDP 1 says we should aspire to train the way we fight, MCDP 4 indicates that successful logistics requires both effectiveness and efficiency, hence that is not always possible. For example, while inherently better from a training perspective to use nothing but tactical communication means for daily operations, the cost of batteries mitigates the use of the base telephone system in garrison.

To perform maintenance as far forward as possible, commanders must decentralize execution of essential tasks. As a general rule, the goal in combat should be centralized control with decentralized execution unless the tactical circumstances or resources demand a different configuration. Similarly, the peacetime goal is centralized control with centralized execution. This is more economical, although not as responsive. In peacetime, economy will frequently outweigh responsiveness in order to conserve resources.

6002. Maintenance Afloat

MAGTF commanders must plan for and conduct maintenance operations during the movement phase of an amphibious operation. Maintenance afloat must be coordinated with ship personnel. Prior planning ensures that parts and materials are readily available to conduct planned maintenance. Expeditionary maintenance operations afloat usually include only those repairs/services that are absolutely necessary. A ship's facilities, with proper coordination, can provide valuable support to the MAGTF's maintenance effort afloat.

a. Maintenance Capabilities Afloat

Due to obvious space restrictions, the maintenance capabilities of embarked MAGTF units are normally very limited. Only maintenance procedures or repairs that are approved by ship personnel and can be accomplished safely are performed. However, commanders should take advantage of this opportunity to improve the readiness of the MAGTF's equipment. Listed

below are maintenance capabilities that can be performed aflqat by MAGTF units.

(1) First Echelon. First echelon is the limited action performed by crews or operators as preventive maintenance. It normally involves cleaning, servicing, lubricating, and other actions within the operators maintenance category. Special consideration must be given to the extremely corrosive environment while embarked and during landing operations. If feasible, crews or operators should conduct either freshwater washdowns or wipedowns as frequently as possible, preferably no less than biweekly.

(2) Second Echelon. Second echelon is the limited action above the operators level performed by organizational mechanics or maintenance contact teams. It normally involves minor repairs, adjusting, inspecting, servicing, and other maintenance actions within the organizational maintenance category.

(3) Third Echelon. Third echelon is the limited component replacement performed by intermediate mechanics or maintenance support teams.

b. Maintenance Procedures Afloat

MAGTF equipment maintenance operations afloat differ slightly from garrison or ashore expeditionary maintenance procedures. Space restrictions require close coordination with ship personnel. Safety regulations may prevent specific types of maintenance from being performed. Additionally, sea conditions and time constraints may restrict maintenance operations. Therefore, the MAGTF unit commander embarked aboard ship outlines, in coordination with ship personnel, the procedures for equipment maintenance afloat.

Climatic conditions aboard ship affect embarked MAGTF weapons and equipment. Dampness and salt water cause corrosion and deterioration to an extent beyond that usually experienced ashore. Therefore, weapons and equipment aboard ship require extra care.

The following topics should be considered while conducting maintenance afloat.

(1) Equipment Stowed Topside. First echelon maintenance is paramount for equipment stowed topside. Whenever possible, equipment should be protected from the weather by canvas and tarpaulins. This must be accomplished without damaging the ship or equipment. Equipment may also require additional maintenance attention due to the harsh environment.

> **WARNING**
>
> **THE SHIP'S VENTILATION SYSTEM MUST BE USED TO PROTECT PERSONNEL AGAINST CARBON MONOXIDE POISONING.**

(2) Equipment Preventive Maintenance. Equipment must be wiped down periodically. First echelon lubrication is performed at regular intervals. Vehicles should be started periodically, whether stowed on the main deck or in holds. Before starting vehicles in a hold, unit maintenance personnel coordinate with ship personnel to ensure that the ship's safety regulations are strictly enforced.

(3) Equipment Inspections. Equipment inspections should be conducted frequently to ensure that all equipment will function properly when debarked. Permission must be obtained from the ship's commander to enter cargo holds for inspections. Inspections should include—

- Equipment waterproofing.
- Gas and oil leakage.
- Batteries and tires.
- Deterioration due to dampness or sea (salt) water.
- Lashing assemblies and shoring to ensure that vehicles remain secured. (This is normally a joint responsibility of the ship's deck department and embarked personnel.)

c. Ship's Maintenance Facilities

All amphibious ships have some type of maintenance facilities or shops to maintain and repair the ship. Most ships have electrical, welding,

carpentry, electronics, and machine shops. These facilities, although not designed to specifically support MAGTF maintenance operations, may be utilized when properly coordinated with ship personnel. The embarked MAGTF commander and staff should be aware of the maintenance facilities aboard ship and coordinate their use by MAGTF personnel if needed.

6003. Maintenance in Maritime Prepositioning Force Operations

The maritime prepositioning force offload preparation party is task-organized and composed of maintenance supervisors (i.e., officers and staff noncommissioned officers), mechanics, technicians, and operators. The offload preparation party deploys prior to the MAGTF to prepare equipment for offload and receipt by the MAGTF. Limited by size, capability, time, and workspace, its work is typically confined to first echelon maintenance and second echelon emergency field expedient repairs. Therefore, corrective maintenance requirements of a more significant nature are identified for resolution by maintenance units at the point of offload.

6004. Maintenance Concepts

a. Organizational Maintenance Concept of Operations

All battalions and regiments have organizational maintenance capabilities. Proper employment of these elements is essential to sustain combat operations. The maintenance contact team is the key element of organizational maintenance in combat. Maintenance contact teams are essential to a successful recovery, evacuation, and repair program. They determine whether an item is repairable at the recovery site. If so, they fix it themselves or obtain parts and additional personnel and tools from the rear. If the equipment is not repairable at or near the recovery site, they supervise evacuation of the equipment. Maintenance contact teams consist of organizational maintenance repairmen with tools, test equipment, and limited repair parts to inspect, diagnose, classify, and repair equipment at forward sites. Depending on the organization, maintenance contact teams can be composed of communications, engineer, motor transport, and/or ordnance repair personnel. The commander determines the exact number of personnel and mix of skills in a maintenance contact team.

Positioning of maintenance contact teams depends largely on the train option selected. If combat trains are used, maintenance contact teams are forward, where they are more responsive to the tactical units they support. If unit trains are used, maintenance contact teams are further to the rear and are not as readily available to inspect, classify, or repair damaged or inoperable items.

Figure 6-1, on page 6-4, shows the notional positioning and relationship among various maintenance agencies in an expeditionary environment. Ground combat element collection points represent the battalion and regimental trains. The terrain and tactical situation dictate the locations of both tactical and combat service support elements. Organizational maintenance elements are generally forward of the division's rear boundary.

b. Intermediate Maintenance Concept of Operations

There are three elements in the intermediate maintenance concept: the maintenance support team, the forward support maintenance detachment, and the CSSE maintenance element.

(1) Maintenance Support Team. The maintenance support team is to intermediate maintenance what the maintenance contact team is to organizational maintenance. Maintenance support teams consist of intermediate maintenance repairmen, tools, test equipment, and repair parts. Maintenance support teams inspect, diagnose, classify, and repair equipment at forward sites. The CSS commander forms maintenance support teams from available intermediate maintenance assets. Unlike maintenance contact teams, maintenance support teams are not routinely forward with the tactical units. They usually work on equipment in the CSSA until sent forward to

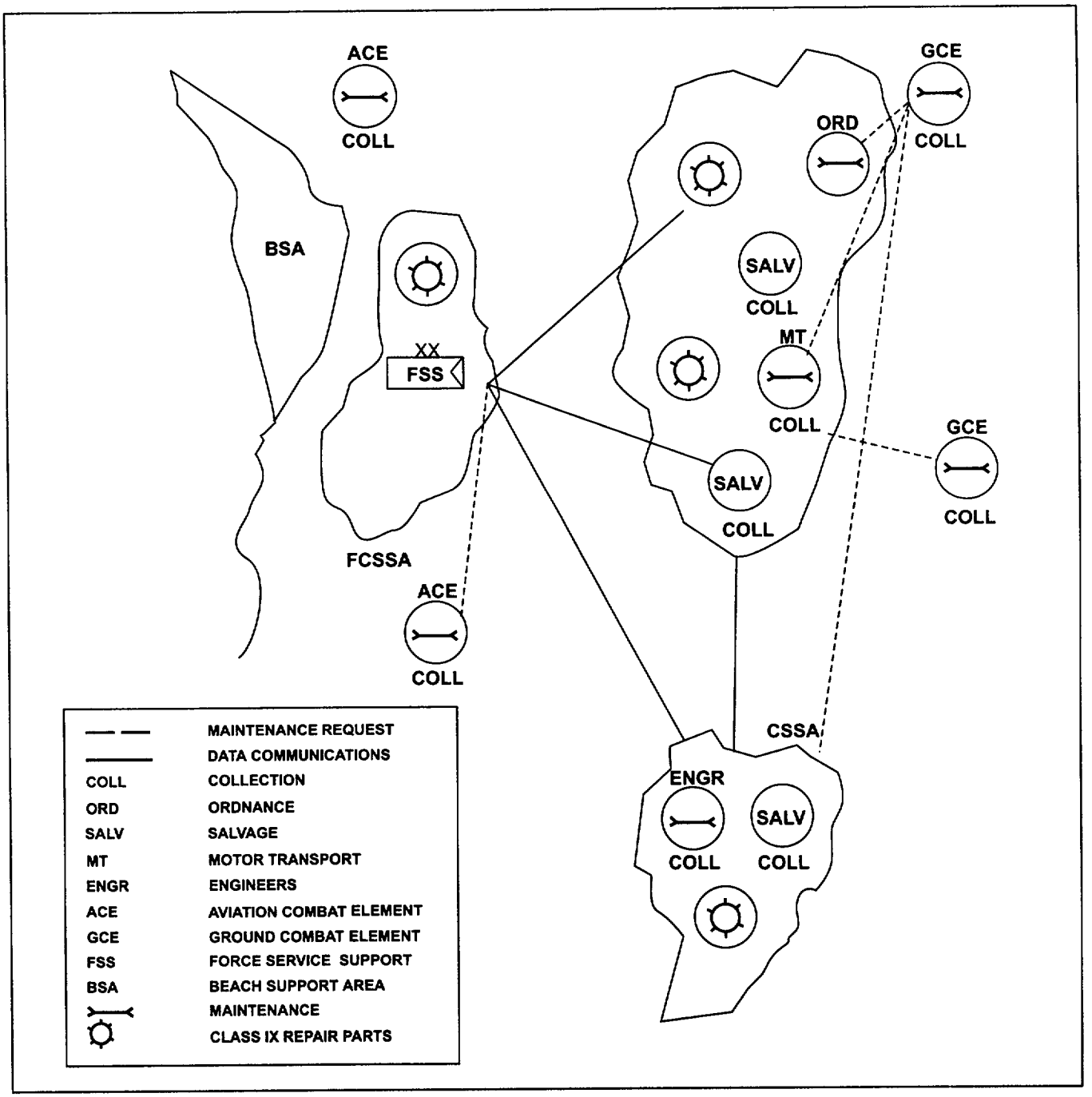

Figure 6-1. Notional Field Maintenance Flow.

repair a specific item of equipment. This permits better use of maintenance and transportation assets while also permitting the maintenance team to draw and bring with them the needed repair parts.

The CSS commander may position maintenance support teams forward; however, this is usually only done when the commander anticipates that the team will have enough work to justify this option. If the commander sends the team forward, a

repair parts block must also be sent. When dispatched, the team remains forward only until the work is completed. Once the work is completed, they return to the CSSA where they are accessible for further missions. Combat service support detachments always have maintenance support teams.

(2) Forward Support Maintenance Detachment. The forward support maintenance detachment is the CSSD maintenance element. It operates the maintenance facilities and maintenance collection points in the combat service support area. Its primary role is to evacuate inoperable equipment from the supported units' collection points and perform intermediate maintenance within its capabilities. The detachment also provides the repairmen, tools, and test equipment for a maintenance support team, which assists organizational maintenance elements. The forward support maintenance detachment is the furthest forward point of entry into the automated maintenance management system.

(3) CSSE Maintenance Element. The CSSE task-organizes to support the deploying force. It can task-organize as an MSSG or FSSG.

The MEU service support group is the smallest CSSE. Although it has extensive capabilities, the MSSG conducts maintenance operations from a single combat service support area. The MSSG commander uses maintenance support teams as needed.

The maintenance capabilities of an FSSG are much greater than an MSSG. These commanders have the assets to form multiple combat service support detachments in addition to retaining a central maintenance capability. The commander establishes a central maintenance capability in the FCSSA. It is here that the CSSE performs the more complex, time-consuming maintenance. The CSSE commander may also create maintenance support teams from these assets to support either organizational maintenance contact teams or to augment subordinate combat service support detachment capabilities during surge periods. Maintenance support teams are usually kept on-call in the FCSSA rather than with either the supported unit or with subordinate combat service support detachments.

6005. Maintenance Support in Combat

a. Maintenance System Adaptability

Ideally, peacetime or garrison systems and expeditionary maintenance systems should be the same. Maintenance systems and procedures must support mission accomplishment during both peace and war. However, peacetime or garrison maintenance procedures may not necessarily transfer to or work effectively for expeditionary maintenance execution under combat conditions. Whenever peacetime maintenance systems and procedures can support or enhance sustainment, the MAGTF should employ them. Where they are cumbersome, redundant, or impossible to administer, the MAGTF must use other techniques and procedures.

b. Maintenance Requests

During combat actions, intermediate maintenance and augmentation of organic maintenance capabilities are performed only by maintenance support teams when requested by the supported unit. Maintenance support teams are drawn either from the supporting combat service support element or maintenance battalion, FSSG. Regardless of the source, maintenance support teams employed forward of the supported unit's rear boundary are requested through and coordinated by the supporting combat service support element.

c. Rear Area Support

In the MAGTF's rear area, the CSSE's maintenance element provides maintenance support. CSSE maintenance elements are task-organized to support mission/operational requirements. Personnel are selected based on their specific skills.

Equipment selections are based on projected needs. The situation determines the size and capabilities of the maintenance element. The larger the maintenance element, the greater the need to stock repair parts, and the less maneuverable the combat service support element. Elements of electronics and general support maintenance companies can be positioned in the rear area to take advantage of captured facilities, security, and the establishment of semi-fixed facilities.

d. Main Area Support

In the vicinity of the FSSG's main area, the maintenance battalion is located in one of the combat service support areas with its companies located in the same or in other combat service support areas to provide dispersion. It is not effective to establish a full range of capabilities in each combat service support area, but establishing complementary capabilities facilitates reconstitution in the event of loss of a combat service support area or redeployment.

e. Forward Area Support

The forward support maintenance detachment is the CSSD's maintenance element that operates maintenance facilities and maintenance collection points in the combat service support area. It evacuates inoperable equipment from the supported units' collection points and performs intermediate maintenance within its capabilities. The forward support maintenance detachment provides the repairmen, tools, and test equipment for the maintenance support teams that assist organizational maintenance elements. The forward support maintenance detachment is the furthest forward point of entry into the automated maintenance management system.

6006. Maintenance Support in the Offense

The ability to maintain momentum and mass at critical points is crucial in the attack. Maintenance operations must be thoroughly integrated into the plan in order to surge support to units preparing for attack. They must also be positioned to respond quickly when repair on site is critical. The situation may dictate repair at the point of malfunction or damage in order to maintain the maximum number of operable and mobile weapon systems. Therefore, mechanics and technicians working in forward areas must be able to meet the increased demands for organizational (first and second echelon) and intermediate (third and fourth echelon) maintenance. Intermediate maintenance elements, in the form of maintenance support teams, may also operate in direct support of lead units in the attack. Maintenance support teams must be properly configured (military occupational specialty and quantity), equipped (transportation, common tools, special tools, and communications), and supplied (components, assemblies, and repair parts) to perform their missions. Noncombat essential repair parts, components, and assemblies should not be carried forward due to their adverse effects on mobility.

Highly trained technicians must make hasty but informed decisions regarding what can be repaired on the site, what should be evacuated, and what should be cannibalized. They must also be capable of determining if operational necessity demands the destruction of damaged equipment to render it useless to the enemy. Guidelines should be set regarding the amount of time devoted to repair on site to determine whether or not equipment should be evacuated or reported to the next higher level and left to be repaired by following units. Contact teams report the location of items left behind to their parent maintenance control element. Parent maintenance control elements coordinate recovery and evacuation of these items. Typically, policy and standing operating procedures require the destruction of equipment (e.g; trucks, tanks, assault amphibious vehicles, artillery) that must be abandoned (operator's equipment manuals provide destruction procedures). The inherent danger of leaving equipment for recovery/salvage is that it provides the enemy the opportunity to exploit/compromise

the equipment. Attempted recovery/salvage of equipment that has been compromised may not be feasible due to the tactical situation and safety.

a. Maintenance During the Amphibious Assault

Assault elements of the landing force are in either scheduled or on-call waves. Assault units usually have few organizational maintenance personnel. The majority of their organizational maintenance capability follows in nonscheduled waves.

The initial maintenance capability, to include limited recovery, evacuation, and repair, is provided by the landing force support party (LFSP). The LFSP maintenance detachment carries a small block of critical repair parts tailored to match the quantity and type of equipment in the assault waves. Due to the intense activity during the assault phase, the LFSP's emphasis will be on replacement of components and assemblies rather than repairing them. The LFSP should be authorized selective interchange and cannibalization to offset the limited depth and breadth of the repair parts block. Immediate tasks of the LFSP maintenance detachment are to establish maintenance and salvage collection points and aggressively implement the recovery and evacuation plan. Assault elements must be made to understand the importance of recovering damaged equipment and returning the equipment to the appropriate collection point. Even extensively damaged items may provide parts for repair of other combat-essential equipment items. Equipment should only be abandoned when the tactical situation leaves no other options. When units are unable to recover equipment, they should report the location to the LFSP for later recovery and evacuation. Assault elements are normally on unit distribution for resupply and should place damaged equipment on resupply vehicles for return to the LFSP.

b. Maintenance During Transition Periods

As the tactical situation stabilizes, assault element commanders phase in their nonscheduled units that include their unit/battalion trains and their organizational maintenance elements. The primary responsibility for maintenance then shifts to the unit owning the equipment. As the assault units' organizational maintenance capability expands, the LFSP shifts its efforts to intermediate maintenance. Assault units initially position their trains near the LFSP to enhance mutual support, avoid unnecessary duplication of effort, and reduce distance between train positions, which also reduces the transportation burden for both maintenance and resupply.

c. Maintenance During Subsequent Operations

Only after the assault follow-on echelon arrives does the combat service support element reach full maintenance capability. When a maintenance unit cannot repair an item, it holds the item at the maintenance collection point or evacuates the item to the next higher level. As the situation continues to mature, the landing force commander phases in additional CSSE units from the assault echelon and maintenance capabilities gradually increase. When satisfied that adequate capability and command and control is established by the CSSE, the landing force commander will disestablish the LFSP, which will be subsequently absorbed into the CSSE.

6007. Maintenance Support in the Defense

The MAGTF maintenance effort's primary thrust in the defense is to prepare the maximum number of combat-ready weapons. Once the defensive battle begins, the priority shifts to repairing the maximum number of damaged/inoperable systems and returning them to the battle as fast as possible. This requires conduct of maintenance on site or as near as possible to the location where the system is employed. Commanders task-organize personnel, equipment, and parts as required to provide responsive maintenance in the forward area. This organization should include trained personnel who are able to diagnose problems quickly, make rapid repairs, or decide to evacuate equipment to the next level of maintenance.

Note: Consideration should also be given to providing maintenance to covering force elements when they return to the ground combat element's rear area so they may be returned more rapidly to a combat-ready condition.

6008. Combat Recovery, Evacuation, and Repair Cycle

Combat recovery, evacuation, and repair capabilities are phased in as more of the MAGTF lands.

a. Recovery

Recovery is the responsibility of the units that own the equipment. Owning units retrieve or arrange to retrieve immobile, inoperative, and/or abandoned materiel. The owning unit's objective is to recover equipment to its maintenance collection point, to a main supply route, or to the combat service support detachment's intermediate maintenance site.

If materiel is not repairable or is permanently unrecoverable, owning units recover salvageable parts and components. Owning units should destroy equipment they cannot recover or that is in danger of capture. If possible, they cannibalize materiel before destroying it.

b. Evacuation

If neither the owning unit nor the combat service support detachment can repair a recovered item, the combat service support detachment evacuates it to the force combat service support area. The combat service support detachment may remove and use parts before evacuating an item if the MAGTF commander has authorized selective interchange. The combat service support detachment evacuates recovered equipment directly to an agency that will repair or dispose of the equipment

c. Priorities

Tactical and combat service support commanders must closely monitor and control recovery and evacuation operations. They must establish priorities that govern recovery and evacuation efforts, and they must carefully allocate personnel and equipment to these efforts. For example, combat vehicles, weapons platforms, and weapons often have a higher recovery priority than other items. The extent of damage also affects recovery priority. When the unit must recover two or more of the same item, they should first recover the item requiring the least repairs.

d. Positioning

Combat and combat support unit commanders should position their recovery capability as far forward as possible. As a rule, their recovery capability consists of the personnel and equipment in their maintenance contact teams. Commanders of intermediate maintenance activities should hold their recovery assets at the force combat service support area or the combat service support area where they can achieve a balance between economy and responsiveness.

Appendix A

Maintenance Shop Organization

Since the basic functions and tasks of a maintenance shop are the same, its organization is fairly standard regardless of shop size or authorized echelon of maintenance. The difference among shops is mainly the workload associated with each function or task and the resources required. This appendix addresses establishment of a basic maintenance shop applicable to a wide range of scenarios.

1. Site Selection

The following characteristics affect selection of a maintenance area site:

- Terrain.
- Environment.
- Tactical situation.
- Unit size and mission.
- Mission maintenance requirements.

Typically, the unit's S-1 and the headquarters commandant share responsibility for selecting the site for the command echelon and allocating space within it. The maintenance area is normally within the limits of the unit's command echelon site. In major subordinate and force level commands, the logistic areas of subordinate service support units normally locate away from the command echelon site. The maintenance areas within these units are selected by the unit's G-3/S-3 with the assistance of the unit's G-4/S-4. Figure A-1 on page A-2 shows a generic layout for a field support maintenance activity.

a. Field Site Selection

Basic considerations that pertain to maintenance site selection are common to any field activity; i.e., cover, concealment, and perimeter security. Other factors also include—

(1) Space Requirements. Space limitations in a maintenance area can cause congestion that could impair maintenance efficiency and safety. A maintenance area should be large enough to provide for the adequate dispersal of equipment and maintenance activities.

(2) Terrain Features. Ideally the terrain should offer concealment from ground and air observation; favor defense against air or ground attacks; facilitate local security; have a hardstand for vehicles and equipment; and be accessible to road, water, and air routes for evacuation and resupply.

(3) Access Routes. Access routes should avoid congested areas and be convenient to users of the maintenance facility. A maintenance area of support maintenance units should be located along the main supply route to provide easy access to supported units and to allow for the evacuation of equipment.

(4) Proximity to Supported Units. The maintenance area is positioned so that it allows each maintenance section to effectively perform its mission. A maintenance area of support maintenance units should be located far enough from supported combat elements to allow continuity of maintenance operations.

(5) Proximity to Other Logistic Elements. The maintenance area is located in close proximity to the unit's other logistic elements to better use common facilities and services.

b. Garrison Site Selection

Garrison site selection of a maintenance area does not differ appreciably from field site

considerations. Since mobility normally is not a major factor in garrison, restrictions on the amount of maintenance capability to collocate with the commodity users are limited only by the unit's maintenance capabilities. Commercial equipment resources should be used to the maximum extent practical to extend tactical equipment life. Proximity of the unit's maintenance area to dining, billeting, and administrative facilities reduces time lost due to travel.

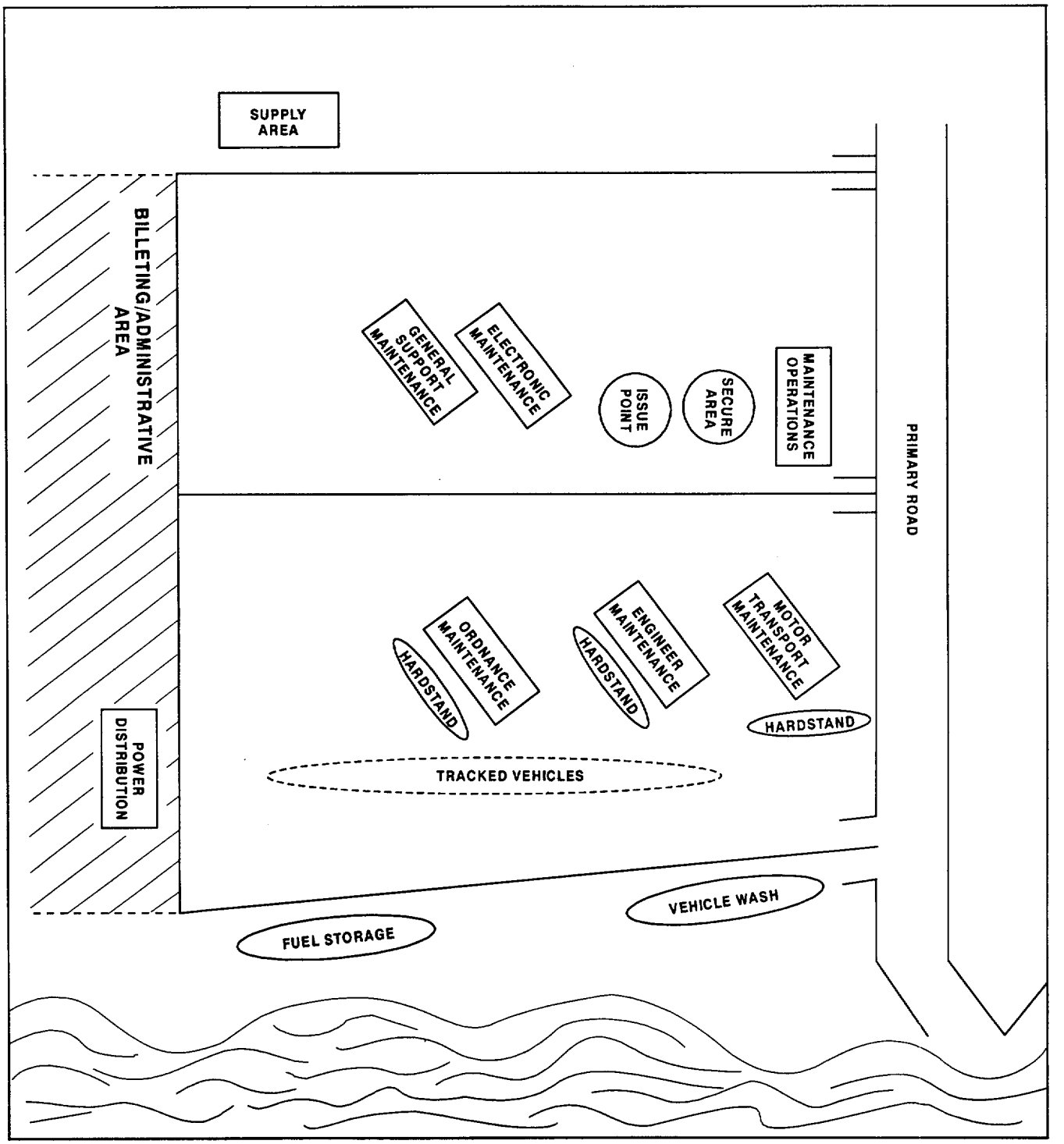

Figure A-1. Layout of a Field Support Maintenance Activity.

2. Organization of the Maintenance Area

The S-4 advises the commander on the assignment of facilities, placement of organic maintenance areas, distribution of utilities, and priority of installation within the maintenance area. Except for purely tactical considerations, the maintenance management officer's recommendations apply equally to the maintenance area in garrison. Commanders must consider the following when organizing the maintenance area:

- Facilities are assigned according to equipment size, density, and anticipated maintenance workload.
- Maintenance shops are positioned according to equipment types. Tracked vehicle maintenance normally is conducted outside of or on the outer limits of the central maintenance area to reduce route maintenance. Structures are erected or assigned based on the need to protect equipment from the climate and to provide comfort to personnel. Drainage considerations are paramount when assigning outside work and storage areas.
- Shops with common requirements for extensive electrical power are positioned so that generators can be shared. Wash racks should be established to serve several users.
- Defensive positions are accessible to the place of work.
- Maintenance hardstands are installed where needed.
- Position of outside illumination must consider the tactical situation and concealment restrictions.
- Secure areas are established away from the perimeter of the unit and where a minimum number of personnel are needed to keep them secure.
- Common issue points are located at the most convenient position for shop use. Commodity-oriented issue points should be located where they best serve the commodity shop.
- Storage areas are designated for fuel, flammable materials, hazardous materials, and hazardous waste. These areas are located away (downhill/downwind) from work and billeting areas, but still convenient for shop use.
- A fire plan is established and consideration given to the positioning of firefighting equipment.
- Hazardous work areas are designated.

3. Maintenance Shop Layout

After the maintenance area site is selected, then the shop layout must be planned. Shop layout involves the organization of equipment and space assigned to a particular shop for the conduct of maintenance operations. Shop layout provides an efficient workflow, safety to personnel, and economic use of support and test equipment. Figure A-2 on page A-4 shows a generic maintenance shop layout plan.

a. Inspection Area

An initial inspection and holding area, which serves as a control point for equipment entering the shop, is the first step in promoting orderly workflow. This area can be divided so that it also provides for final inspection and holding of completed maintenance items. The inspection area should prevent overcrowding of the shop's active maintenance by controlling input, holding completed work, and eliminating customers from the work areas.

b. Shop Office

The shop office should be located adjacent to the inspection and holding area. This location makes it convenient to shop customers and facilitates the processing of paperwork. The administrative and management support provided by the shop office requires that office personnel have easy access to the remainder of the shop.

c. Common-Use Items

Common areas and equipment used by all shop maintenance personnel should be located so they are easily accessible. Some of these include—

- A technical library (the shop library should be immediately accessible to the work area).

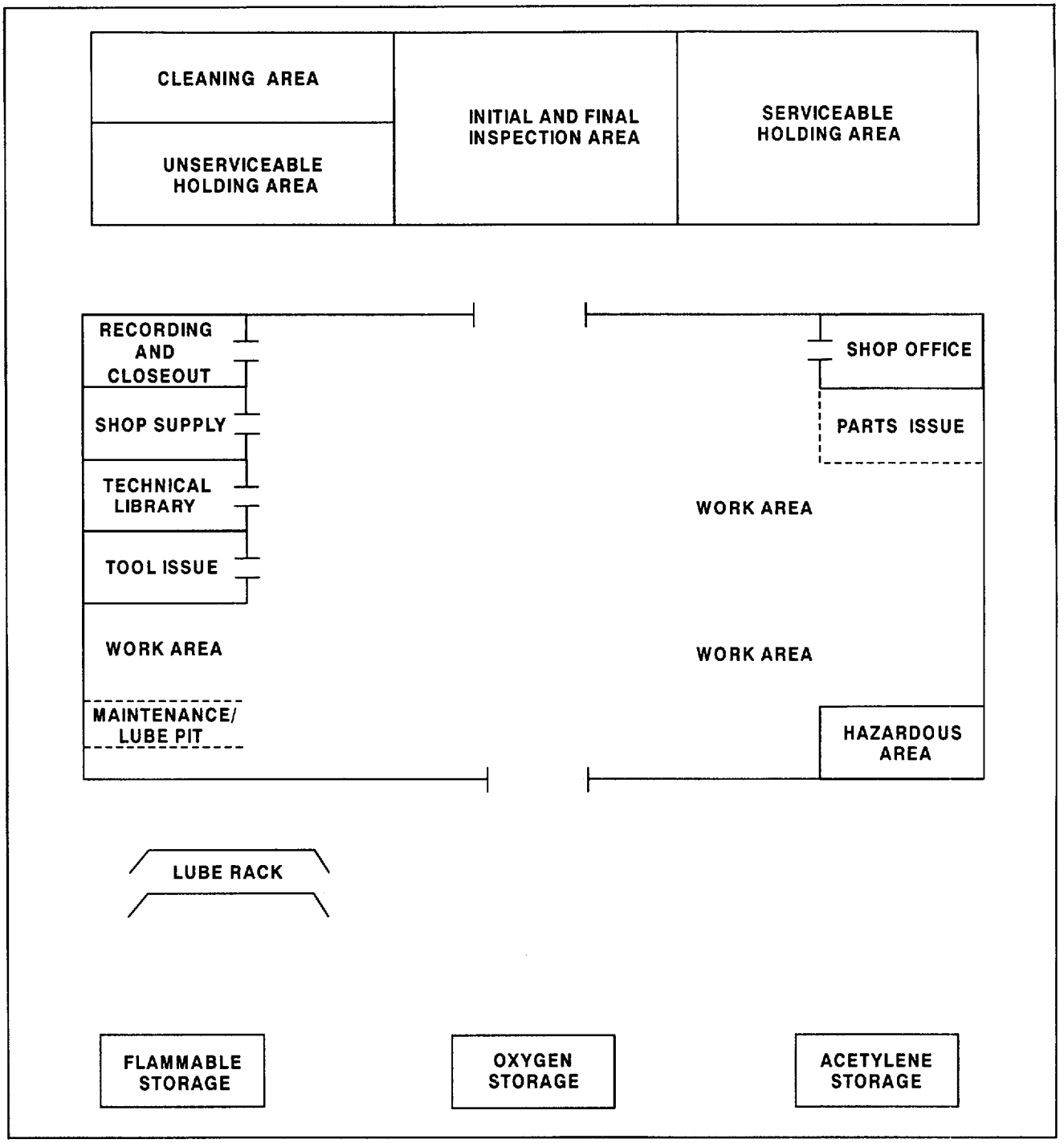

Figure A-2. Maintenance Shop Layout.

- Repair parts and materials (shop stores and pre-expended bins should be located in close proximity to work areas).
- A scrap collection point (a central collection point for scrap should be established to keep work areas clear and facilitate easy collection and removal of refuse from the shop).
- Support and test equipment (equipment used primarily by one mechanic should be located as close as possible to the mechanic's place of use; however, a central location for low-density, common-use tools facilitates tool availability and is preferred).

d. Workflow

The shop office controls the flow of work through the shop. Work should not be inducted until adequate resources (e.g., space, personnel, and parts) are available to perform the necessary work. This reduces the chance of a work stoppage and effectively utilizes maintenance space.

e. Paper Flow

Equipment repair orders, logbooks, equipment records, and any other appropriate paperwork should accompany the equipment through the shop during its various phases of maintenance. The ERO and other equipment records required for the performance and recording of maintenance actions are checked at the acceptance inspection for accuracy and completeness. This ensures that the necessary paperwork is available to the mechanics and technicians performing the work during the active maintenance phase. A shop officer monitors and controls the paper flow. ERO logs and status boards are recommended methods for monitoring both supply and maintenance actions if automated reports are not available. Once active maintenance is completed and the equipment is ready to leave the shop, records should be returned to the administrative section for processing and closing. When returning equipment to the owning unit, the person receiving it must ensure that all records delivered with the equipment are returned and complete.

Appendix B

Marine Corps Integrated Maintenance Management System and the Field Maintenance Subsystem

The Marine Corps Integrated Maintenance Management System is an automated management system. Operating force commanders and supporting establishment commanders use MIMMS to perform Marine Corps ground equipment maintenance. It is organized into three subsystems: the Headquarters Maintenance Subsystem, the Depot Maintenance Subsystem, and the Field Maintenance Subsystem.

1. Headquarters Maintenance Subsystem

The Headquarters Maintenance Subsystem supports commodity managers at Headquarters Marine Corps. It allows commodity managers (i.e., motor transport, communications-electronics, engineer, and ordnance) to enter standard data into the Marine Corps Integrated Maintenance Management System and to maintain a data base of selected maintenance information. The Headquarters Maintenance Subsystem data base is comprised of information extracted from the Field Maintenance Subsystem. It facilitates selective maintenance engineering analysis, logistic readiness evaluation, and maintenance management for specified functions required by the Headquarters Maintenance Subsystem user.

2. Depot Maintenance Subsystem

The Depot Maintenance Subsystem supports the materiel functions of the two Marine Corps depot maintenance activities: one located at Albany, Georgia and the other at Barstow, California. The Depot Maintenance Subsystem provides materiel and production control information and cost and labor accounting information.

3. Field Maintenance Subsystem

The Field Maintenance Subsystem was developed to improve and standardize equipment status reporting and management, while reducing and consolidating manual reporting requirements. It provides operating force commanders with timely and accurate information concerning the status of equipment currently in the maintenance cycle. This system provides for the reporting of active maintenance and repair parts information, production of selected SASSY transactions, collection of historical costs, and tracking of maintenance engineering and modification control information. Reports and listings are generated from information generated by the Field Maintenance Subsystem on both a scheduled and nonscheduled basis. See UM 4790-5, *MIMMS Automated Information System Field Maintenance Procedures*, for user instructions.

a. Input Sources

The Field Maintenance Subsystem receives input primarily from two source documents: NAVMC Form 10245, *Equipment Repair Order* and NAVMC Form 10925, *ERO Shopping/Transaction List*. NAVMC Form 10245 is commonly referred to as the ERO, and NAVMC Form 10925 is commonly referred to as the ERO Shopping List (EROSL).

The ERO is used for all maintenance actions applied beyond the first echelon. Maintenance performed and requests for higher echelons of maintenance are recorded on the ERO.

The EROSL, often referred to as a shopping list, is used to requisition, receipt for, cancel, and record partial issues and credits of repair parts and secondary reparable items associated with equipment being repaired. It also serves as an excellent source document for unit supply input and provides a method for processing unit maintenance input to the Field Maintenance Subsystem.

The ERO and EROSL are completed by maintenance and supply personnel at the using unit and by the activity repairing the equipment. At the battalion level, the appropriate maintenance shop (e.g; motor transport, armory) or the supply section completes the ERO and EROSL. Within the force service support group, the appropriate equipment maintenance company of the maintenance battalion completes the ERO and EROSL. TM 4700-15/1 contains instructions for completing both forms.

b. Input to the Data Base

Each battalion inputs data into the data base. Maintenance and supply information are converted into the appropriate input transaction type and transmitted to the supporting automated services center for entry into the Field Maintenance Subsystem data base. The conversion is accomplished using source data automation equipment. Transactions are verified on machine media and transferred to the automated services center for storage and production of Field Maintenance Subsystem reports.

c. Data Base Output

Maintenance management officers at all levels are responsible to their commanders for all aspects of their unit's maintenance programs, which includes Field Maintenance Subsystem operations. Their duties include establishing and disseminating procedures for the submission of information and the dissemination of output reports, evaluating maintenance ship performance using Field Maintenance Subsystem output reports, and training personnel in all aspects of Field Maintenance Subsystem operations.

The FSSG's information systems coordinator sponsors and coordinates Field Maintenance Subsystems operations within a Marine expeditionary force. The information systems coordinator coordinates and disseminates system changes or directives from higher headquarters; consolidates system changes, modification requests, and impact statements from adjacent major commands to higher headquarters; coordinates the schedule for submission/dissemination of daily input and output reports; and prepares work requests for all update cycles and reports.

4. Reports

Report information is based on the input provided by technicians at the working level. Therefore, commanders must ensure that personnel are trained, guided, and motivated to perform their jobs effectively and to report relevant information. These reports are used in two critical activities: validation of requisitions and reconciliation of readiness, maintenance, and supply reports. Validation involves confirming that repair parts on order are still needed, and that cancellations, receipts, scrounges, and current statuses are properly reflected. Reconciliation of information among maintenance, supply, and readiness reports is accomplished by the maintenance management officer in concert with commodity and supply representatives. Reconciliation is the means to monitor the status of mission-essential deadlined equipment and to identify any recurring errors or trends in maintenance or requisitioning procedures that could result in delay. While not all inclusive, the following is a list of reports essential to managing the maintenance effort:

- Daily Process Report.
- Field Maintenance Production Report.

- MIMMS LM2 Unit Report.
- Weekly Maintenance Exception Report.
- Weekly Materiel Report.
- Weekly Owning Unit Maintenance TAM Report.

a. Weekly Maintenance Exception Report

The Weekly Maintenance Exception Report is an effective tool that provides a summary of pending supply and maintenance items and identifies discrepancies. A weekly comparison of two or three consecutive reports can help determine procedural problems, developing trends, and aid in determining corrective action. Report information is printed in narrative form and is very easy to comprehend.

b. Weekly Owning Unit Maintenance TAM Report

The Weekly Owning Unit Maintenance TAM Report, commonly referred to as the TAM report, provides the specific repair status of individual pieces of equipment within a unit's maintenance cycle. This report is produced weekly in table of authorized number sequence. It includes active EROs at intermediate and organizational maintenance activities and the latest job status. The TAM report is used to identify unfavorable trends in equipment defects, priority assignments, job status, days deadlined, and days in shop. The TAM report also provides ERO information from the intermediate maintenance level to determine current status of equipment that was evacuated to a higher echelon for repair.

c. Daily Process Report

The Daily Process Report is used predominantly by leaders of organizational maintenance sections. The Daily Process Report contains complete maintenance and repair parts information regarding each ERO opened by a section. Section heads use the Daily Process Report to track equipment repair performed by the respective unit repair ships.

The Daily Process Report provides a presentation of both supply and maintenance data. The shop chief generally uses the information in day-to-day operation. It is useful in the conduct of periodic, informal inspections to identify work stoppages and delays, outstanding parts requisition, disagreements between maintenance and repair parts priorities, added parts, and parts needed for deadlined equipment.

Appendix C

Maintenance Directives, Technical Manuals, and Stock Lists

The Marine Corps establishes maintenance guidelines so that all commanders can comply with procurement regulations and perform required equipment maintenance. These guidelines are set forth in directives that establish maintenance goals. These directives can contain broad guidance or very specific instructions. Equipment technical manuals and Marine Corps stock lists support these directives. This appendix introduces some of the more widely used maintenance resources.

1. Basic Maintenance Directives and Policies

There are numerous directives that provide policies and procedures for every level of authorized maintenance required for MAGTF equipment. It is essential that all commanders and their staffs be aware of basic directives and key policies that apply to their organization.

a. The Marine Corps Manual

The Marine Corps Manual is the capstone publication for policy statements issued by the Commandant of the Marine Corps. It contains policies that supplement naval regulations established by the Secretary of the Navy. The guidance contained in *The Marine Corps Manual* is very broad and it is amplified by other Marine Corps publications. The manual's section devoted to maintenance has five basic policies that commanders should be familiar with—

- Maintenance is a command responsibility. Therefore, commanders are responsible for ensuring that assigned equipment is properly maintained to ensure the effective performance of mission requirements.
- The categories and echelons of maintenance to be performed are assigned to specific levels of command as determined by the mission and resources assigned. This maintenance authority is prescribed in the unit's table of organization logistic capabilities statement. Standard ground equipment policies and procedures are followed at all levels of command, for all equipment commodity areas, and all echelons of maintenance throughout the Marine Corps. Maintenance and maintenance management procedures and systems used when the unit is deployed will not differ from those used in a garrison environment.
- Repairs are performed at the lowest, authorized echelon of maintenance and as far forward as possible to enhance the tactical situation. The evacuation of equipment reduces combat and combat support strength. Evacuation to a higher echelon of maintenance is accomplished only after prescribed fault diagnosis and isolation has been accomplished at the previous echelon of maintenance. Each echelon is authorized to perform lower echelon repair operation.
- Marine Corps equipment is modified only as directed or approved by the Commandant of the Marine Corps.
- Commanders order periodic inspections of their materiel. The scope of the inspection shall conform generally to the authorized echelon of maintenance. They must include a schedule of technical inspections that cover all pertinent areas performed by qualified personnel.

b. MCO P4790.2

MCO P4790.2, *MIMMS Field Procedures Manual*, provides MAGTF units with a comprehensive guide for the standardized management of ground equipment maintenance. It sets forth detailed maintenance functions and responsibilities and establishes procedures for the full implementation of MIMMS. MCO P4790.2 also amplifies the broad policies contained in other directives such as the Marine Corps Manual.

There are two important policies in MCO P4790.2 that commanders and their staffs must be aware of.

First, commanders at major subordinate commands, including detached or separate commands, authorized second echelon or higher maintenance capabilities for more than one commodity area shall publish maintenance management standing operating procedures except when maintenance procedures are adequately covered in the major subordinate command's maintenance management SOP. In such cases, the major subordinate command's maintenance management SOP may be used in lieu of a unit standing operating procedure. The instructions contained in the command's maintenance management SOP need not contain all subordinate unit functions; however, they will be clear, completely applicable at the unit level, and sufficiently detailed to ensure each subordinate unit can perform its maintenance mission.

Second, commands, to include detached or separate commands, authorized a second echelon or higher maintenance capability for more than one commodity area will assign an officer or staff noncommissioned officer as the maintenance management officer. The appointment must be in writing and emphasize the significance of the maintenance management officer's duties.

2. Technical Manuals

Mechanics should use the applicable technical manual to ensure that inspection and repair procedures are effectively applied. The Marine Corps has a comprehensive technical publication system that supports the maintenance effort at all echelons. The commander and maintenance management officer ensure that an effective publication control program is established (see MCO P4790.2 for guidance). It is the unit commander's responsibility to ensure that current maintenance publications are on-hand and used.

a. TM 4700-15/1

TM 4700-15/1, *Ground Equipment Record Procedures*, establishes uniform recordkeeping procedures to record and account for maintenance performed on ground equipment. Recordkeeping procedures include the preparation, use, and disposition of required forms and records associated with the receipt, transfer, use, maintenance, repair, and disposal of all Marine Corps tactical equipment. Information is arranged into separate chapters for each type of equipment: communications-electronic, motor transport, engineer, and ordnance. This manual is an excellent reference for commanders and their staffs to use when spot checking the reported condition of unit equipment and the maintenance commodity support procedures.

b. Equipment Technical Manuals

Equipment technical manuals provide instructions for the performance of authorized maintenance on specific equipment for each category of maintenance. Technical manuals are published by the Service that is designated as the item manager of a particular piece of equipment. For example, TM 9-1025-211-10 is the operator's manual for the howitzer medium, towed, 155mm, M198 and is published by the U.S. Army (the item manager for artillery weapons). TM 08594A-10/2 is the operator's manual for the light armored vehicle-25 and is published by the Marine Corps (its item manager). Regardless of the publisher, technical manuals are available from the Commanding General, Marine Corps Logistics Base, Albany, Georgia.

Each part of an equipment technical manual is identified by a basic number that identifies the type of equipment and the echelon of maintenance. For example, in the M198 howitzer series

TM 9-1025-211-10, TM 9-1025-211-20, and TM 9-1025-211-34 exist as technical manuals:

- The first eight digits (9-1025-211) identify the type of equipment (howitzer, medium, towed, 155mm, M198).
- The -10 identifies the manual as the 1st echelon, operator/crew instructions.
- The -20 identifies the manual as 2d echelon maintenance instructions.
- The -34 identifies the manual as 3d and 4th echelon maintenance instructions.

Technical manuals that end with the letter "P" are parts manuals. Technical manuals are published in five parts to facilitate distribution and use. These parts are discussed below.

(1) Operator/Crew Manual (-10). This part of an equipment technical manual contains operation and maintenance instructions for the operator or crew. It is also known as the "ten" manual because its technical manual number has the suffix -10. The operator technical manual instructs the operator/crew on how to shoot, move, and maintain a specific item of equipment. It usually outlines before, during, and after maintenance services performed on the equipment, both daily and periodic maintenance requirements. Operator and crew technical manuals should be kept on the equipment when it is dispatched to provide ready access by the operator.

(2) Organizational Maintenance Manual (-20). This is the second part within the technical manual series for a given item of equipment. This technical manual provides instructions for second echelon maintenance personnel. It provides mechanics and technicians with step-by-step procedures for troubleshooting and repairing equipment malfunctions. It also contains guidelines for the performance of second echelon preventive maintenance services.

(3) Intermediate/Depot Manuals (-30, -40, -50). Third, fourth, and fifth echelon maintenance instructions are contained in specific technical manuals and designed with the suffix -30,-40, or -50, respectively. The instructions for each echelon may be so limited or so similar that publishing separate parts as individual technical manuals are not necessary. For example, the M198 howitzer has one technical manual that addresses two echelons of maintenance (TM 9-1025-211-34).

(4) Lubrication Instruction and Lubrication Order. Lubrication instructions and lubrication orders furnish technical information and instructions on the service, lubrication, and other related preventive maintenance checks and services required for equipment or material. A lubrication instruction, also identified as an lubrication order (depending on the Service sponsor), prescribes equipment lubrication instructions, describes proper lubricants, establishes required intervals and explains lubrication maintenance. The difference between the lubrication instruction and the lubrication order is that the lubrication instruction applies to Marine Corps-sponsored equipment (Marine Corps-peculiar equipment) and the lubrication order applies to equipment sponsored by another Service. For example, a lubrication instruction exists for a D7G tractor that is sponsored by the Marine Corps and a lubrication order exists for a 5-ton M939 truck that is sponsored by the Army.

(5) Modification Instruction. Many items require modifications to improve safety and/or operating characteristics. When a modification is required, the Marine Corps issues a publication known as a modification instruction.

(6) Technical Instruction. Technical instructions provide technical information on equipment, materiel, and programs. For example, TI 4710-14/1 provides technical instruction for the replacement or evacuation of Marine Corps ground equipment or TI 4731-14/1 provides technical instruction on a particular oil program.

3. Marine Corps Stock Lists

Stock lists provide all levels of Marine Corps supply and maintenance operations with essential, up-to-date information for Marine Corps-managed items.

a. SL-1-2

The SL-1-2 identifies technical publications required to support a unit's assigned equipment. It lists publications for each piece of equipment. It provides the publication's number, current date, and any changes that have been issued. Commanders use the SL-1-2 to ensure that their units have the required, up-to-date technical publications on-hand.

b. SL-1-3

The SL-1-3 lists all current and superseded publications by their publication control number and by their short title (e.g., MCDP 1). The SL-1-3 also provides amplifying information needed to order and maintain a unit's publication library. This includes general subject publications that may not be listed in the SL-1-2.

c. SL-3

The SL-3 provides component listings for every end item. It identifies the national stock number; quantity; unit of issue; and source, maintenance, and recoverability code (SMR). The SL-3 also identifies if an item is an actual component of the end item or if the using unit provides the item that is to be used with the end item. Operators, use the SMR code to identify whether the component, when defective, is to be turned in to a maintenance support facility for second echelon repair or replaced at the first echelon maintenance level.

d. SL-4

The SL-4 conveys supply and maintenance information to unit maintenance personnel. It lists the repair parts that apply to an end item, component, or major assembly requiring maintenance and supply support. The SL-4 provides national stock numbers for ordering parts, graphic presentation of each part for easy identification, unit of issue (measurements by which the item is dispensed; e.g., each, feet, pounds), quantity of repair part being applied to the end item, and SMR code.

The SMR code provides important information to maintenance personnel. It identifies the lowest echelon of maintenance authorized to remove and/or install a part and to perform the complete repair of that part. Commanders should occasionally question maintenance personnel concerning their use of the SMR code to demonstrate interest in unit maintenance operations, to determine their maintenance personnel's knowledge in prescribed procedures, and to determine if training deficiencies exist.

Appendix D

Glossary

Section I. Acronyms and Abbreviations

CSS ..... combat service support
CSSA ..... combat service support area
CSSD ..... combat service support detachment
CSSE ..... combat service support element

ERO ..... equipment repair order
EROSL ..... equipment repair order shopping/transaction list

FAD ..... force activity designator
FCSSA ..... force combat service support area
FM ..... field manual
FMFM ..... Fleet Marine Force manual
FMFRP ..... Fleet Marine Force reference publication
FMSS ..... Field Maintenance Subsystem
FSSG ..... force service support group

HQMC ..... Headquarters, U.S. Marine Corps

LFSP ..... landing force support party
LI ..... lubrication instruction
LO ..... lubrication order
LZSA ..... landing zone support area

MAGTF ..... Marine air-ground task force
MAL ..... mechanized allowance list
MCBul ..... Marine Corps bulletin
MCDP ..... Marine Corps Doctrinal Publication
MCGERR ..... Marine Corps ground equipment resource reporting
MCO ..... Marine Corps Order
MCPDS ..... Marine Corps Publications Distribution System
MCRP ..... Marine Corps reference publication
MCWP ..... Marine Corps warfighting publication
MIMMS ..... Marine Integrated Maintenance Management System
MSSG ..... MEU service support group

NAVMC ..... Navy/Marine Corps
NAVSEAOP .... Naval Sea Systems Command operating procedures

OPNAVINST ..... Office of the Chief of Naval Operations instruction

PLMS ..... Marine Corps Publications Library Management System
PMCS ..... preventive maintenance checks and services

SASSY ..... Supported Activities Supply System
SL ..... stock list
SMR ... source, maintenance, and recoverability
SOP ..... standing operating procedure

TAM ..... table of authorized materiel
T/E ..... table of equipment
TI ..... technical instruction
TM ..... technical manual
TMDE ..... test, measurement, and diagnostic equipment
T/O ..... table of organization

UM ..... users manual

Section II. Definitions

A

assembly—In logistics, an item forming a portion of an equipment, that can be provisioned and replaced as an entity and which normally incorporates replaceable parts or groups of parts. See **part; subassembly**. (Joint Pub 1-02)

B

back order—The quantity of an item requisitioned by ordering activities that is not immediately available for issue but is recorded as a stock commitment for future issue. (Joint Pub 1-02)

C

cannibalize—To remove serviceable parts from one item of equipment in order to install them on another item of equipment. (Joint Pub 1-02)

collateral equipment—The equipment consisting of secondary items which are functionally related to an end item, but are not considered a part of them. The materiel is identified in the SL-3 (stock list) for the end item under the headings; supply system responsibility, using unit responsibility, and collateral materiel. An end item is considered complete only when the total quantity of items shown in the SL-3 are on hand. Repair parts, spare parts, and components are not considered collateral equipment. (MCO P4790.2)

combat essential equipment (CEE)—Items designated as CEE or pacing items that are of such importance that they are subject to continuous monitoring and management at all levels of command. Items eligible for nomination as CEE items must be listed in the JCS Major Equipment File. This file is maintained by the CMC (Code POC). CEE items are identified by table of authorized materiel control number in an enclosure to the Marine Corps Bulletin in the 3000 series. (MCO 3000.11)

combat service support—The essential capabilities, functions, activities, and tasks necessary to sustain all elements of operating forces in theater at all levels of war. Within the national and theater logistic systems, it includes but is not limited to that support rendered by service forces in ensuring the aspects of supply, maintenance, transportation, health services, and other services required by aviation and ground combat troops to permit those units to accomplish their missions in combat. Combat service support encompasses those activities at all levels of war that produce sustainment to all operating forces on the battlefield. (Joint Pub 1-02)

combat service support area—An area ashore that is organized to contain the necessary supplies, equipment, installations, and elements to provide the landing force with combat service support throughout the operation. (Joint Pub 1-02)

combat service support elements—Those elements whose primary missions are to provide service support to combat forces and which are a part, or prepared to become a part, of a theater, command, or task force formed for combat operations. (Joint Pub 1-02)

commodity area—A grouping or range of items which possess similar characteristics, have similar applications, and are susceptible to similar logistics management methods. The commodity areas in use in the Marine Corps and table of

authorized materiel control number (TAMCN) commodity designators are as follows:

(1) ..... Communications-Electronics (C&E). A, H, and T.
(2) ..... Engineer (Eng). B, K, and U.
(3) ..... Motor Transport (MT). D, M, and W.
(4) ..... Ordnance (Ord). E, N, and X.
(5) ..... Garrison Mobile Equipment (GME). G.
(6) ..... General Supply (GS). C, K, and V.
(7) .... Nuclear, Biological, Chemical (NBC). NBC equipment carries Eng, C&E, and GS commodity designators. (MCO P4790.2)

component (materiel)—An assembly or any combination of parts, subassemblies, and assemblies mounted together in manufacture, assembly, maintenance, or rebuild. (Joint Pub 1-02)

corrective maintenance—Maintenance actions carried out to restore a defective item to a specified condition. (Joint Pub 1-02, NATO definition)

corrosion—The deterioration of a material, usually a metal, because of a reaction with the immediate environment. (MCO 4796.2C)

D

deadline—To remove a vehicle or piece of equipment from operation or use for one of the following reasons: **a.** is inoperative due to damage, malfunctioning, or necessary repairs. The term does not include items temporarily removed from use by reason of routine maintenance, and repairs that do not affect the combat capability of the item; **b.** is unsafe; and **c.** would be damaged by further use. (Joint Pub 1-02)

depot maintenance—That maintenance performed on materiel requiring major overhaul or a complete rebuild 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 by using more extensive facilities for repair than are available in lower level maintenance activities. (Joint Pub 1-02)

desk top procedures—Usually a file folder or loose-leaf binder of instructions, procedures, references, and notes pertaining to the everyday duties and operations of a personnel billet. Desk top procedures should standardize requirements, actions, and record keeping. See **turnover folder**. (MCO P4790.2)

direct support (DOD)—A mission requiring a force to support another specific force and authorizing it to answer directly the supported force's request for assistance. (Joint Pub 1-02)

E

end item (DOD)—A final combination of end products, component parts, and/or materials that is ready for its intended use, e.g., ship, tank, mobile machine shop, aircraft. (Joint Pub 1-02)

ERO parts bin (layette)—An area where the parts ordered on an EROSL for an ERO are stored waiting to be placed on the equipment. The area can be a shelf or a box or something similar. All parts for the same ERO are kept together in the same bin, the location of which is normally indicated by the ERO number. The parts are also tagged/marked with the applicable ERO number. (MCO P4790.2)

evacuation—1. The controlled process of collecting, classifying, and shipping unserviceable or abandoned materiel, United States and foreign, to appropriate reclamation, maintenance, technical intelligence, or disposal facilities. (Joint Pub 1-02) **2. evacuation**—A controlled process of moving equipment which cannot be repaired, modified, serviced, or utilized by the owner to the organization which can effect the necessary equipment maintenance or redistribute the equipment to another user or storage/disposal facility. (MCO P4790.2)

F

Fleet Marine Force (DOD)—A balanced force of combined arms comprising land, air, and service elements of the U.S. Marine Corps. A Fleet Marine Force is an integral part of a U.S. Fleet and has the status of a type command. (Joint Pub 1-02)

float (maintenance)—Components of equipment authorized for stockage at installations or activities for replacement of unserviceable items of equipment when immediate repair of unserviceable equipment cannot be accomplished at the organic level of maintenance. (MCO P4400.150)

G

general support—That support which is given to the supported force as a whole and not to any particular subdivision thereof. (Joint Pub 1-02)

H

host nation support—Civil and/or military assistance rendered by a nation to foreign forces within its territory during peacetime, crises or emergencies, or war based on agreements mutually concluded between nations. (Joint Pub 1-02)

I

in support of—Assisting or protecting another formation, unit, or organization while remaining under original control. (Joint Pub 1-02)

intermediate maintenance (field)—That maintenance which is the responsibility of and performed by designated maintenance activities for direct support of using organizations. Its phases normally consist of **a.** calibration, repair, or replacement of damaged or unserviceable parts, components, or assemblies; **b.** the emergency manufacture of nonavailable parts; and **c.** providing technical assistance to using organizations. (Joint Pub 1-02)

item manager—An individual within the organization of an inventory control point or other such organization assigned management responsibility for one or more specific items of materiel. (Joint Pub 1-02)

J

joint—Connotes activities, operations, organizations, etc., in which elements of two or more Military Departments participate. (Joint Pub 1-02)

L

limited technical inspection (LTI)—Equipment inspections that are limited in scope and objective. LTIs are generally directed at inspecting equipment conditions to determine the extent and level of maintenance required to restore it to a specified condition or to check for serviceability status. (MCO P4790.2)

logistics—The science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, those aspects of military operations which deal with: **a.** design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of materiel; **b.** movement, evacuation, and hospitalization of personnel; **c.** acquisition or construction, maintenance, operation, and disposition of facilities; and **d.** acquisition or furnishing of services. (Joint Pub 1-02)

M

maintenance area—A general locality in which are grouped a number of maintenance activities for the purpose of retaining or restoring materiel to a serviceable condition. (Joint Pub 1-02)

maintenance categories/echelons—The subdivisions of maintenance which permit the assignment of maintenance responsibility to various levels within units/organizations. The categories of maintenance and corresponding echelons of maintenance are as follows: organizational (first and second echelons), intermediate (third and fourth echelons), and depot (fifth echelon). (MCO P4790.2)

maintenance cycle time—That period of time during which equipment is inoperative and requires repair. (MCO P4790.2)

maintenance management—The retention or restoration of materiel to a serviceable condition through the efforts of other people. (MCO P4790.2)

maintenance management officer (MMO)—An officer designated to perform the general duties of a special staff officer under the staff cognizance of the G/S-4 and is the primary point of contact in maintenance management matters. (MCO P4790.2)

maintenance (materiel)—1. All action taken to retain materiel in a serviceable condition or to restore it to serviceability. It includes inspection, testing, servicing, classification as to serviceability, repair, rebuilding, and reclamation. **2.** All supply and repair action taken to keep a force in condition to carry out its mission. **3.** The routine recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such condition that it may be continuously used, at its original or designed capacity and efficiency for its intended purpose. (Joint Pub 1-02)

maintenance resources—Maintenance resources include: time, personnel, repair parts, tools and equipment, facilities, funds, and publications. (MCO P4790.2)

maintenance status—1. A nonoperating condition, deliberately imposed, with adequate personnel to maintain and preserve installations, materiel, and facilities in such a condition that they may be readily restored to operable condition in a minimum time by the assignment of additional personnel and without extensive repair or overhaul. **2.** That condition of materiel which is in fact, or is administratively classified as, unserviceable, pending completion of required servicing or repairs. (Joint Pub 1-02)

Marine air-ground task force—A task organization of Marine forces (division, aircraft wing and service support groups) under a single command and structured to accomplish a specific mission. The Marine air-ground task force (MAGTF) components will normally include command, aviation combat, ground combat, and combat service support elements (including Navy Support Elements). Three types of Marine air-ground task forces which can be task organized are the Marine expeditionary unit, Marine expeditionary force and special purpose Marine air-ground task force. The four elements of a Marine air-ground task force are: **a. command element (CE)**—The MAGTF headquarters. The CE is a permanent organization composed of the commander, general or executive and special staff sections, headquarters section, and requisite communications and service support facilities. The CE provides command, control, and coordination essential for effective planning and execution of operations by the other three elements of the MAGTF. There is only one CE in a MAGTF. **b. aviation combat element (ACE)**—The MAGTF element that is task organized to provide all or a portion of the functions of Marine Corps aviation in varying degrees based on the tactical situation and the MAGTF mission and size. These functions are air reconnaissance, antiair warfare, assault support, offensive air support, electronic warfare, and control of aircraft and missiles. The ACE is organized around an aviation headquarters and varies in size from a reinforced helicopter squadron to one or more Marine aircraft wing(s). It includes those aviation command (including air control agencies), combat, combat support, and combat service support units required by the situation. Normally, there is only one ACE in a MAGTF. **c. ground combat element (GCE)**—The MAGTF element that is task organized to conduct ground operations. The GCE is constructed around an infantry unit and varies in size from a reinforced infantry battalion to one or more reinforced Marine division(s). The GCE also includes appropriate combat support and combat service support units. Normally, there is only one GCE in a MAGTF. **d. combat service support element (CSSE)**—The MAGTF element that is task organized to provide the full range of combat service support necessary to accomplish the MAGTF mission. CSSE can provide supply, maintenance, transportation, deliberate engineer, health, postal, disbursing,

enemy prisoner of war, automated information systems, exchange, utilities, legal, and graves registration services. The CSSE varies in size from a Marine expeditionary unit (MEU) service support group (MSSG) to a force service support group (FSSG). Normally, there is only one combat service support element in a MAGTF. (Joint Pub 1-02)

maritime prepositioning force—A task organization of units under one commander formed for the purpose of introducing a MAGTF and its associated equipment and supplies into a secure area. The MPF is composed of a command element, a maritime prepositioning ships squadron, a MAGTF, and a Navy support element. (FMFRP 0-14)

modification; equipment—Consists of those maintenance actions performed to change the design or assembly characteristics of equipment systems, end items, assemblies, subassemblies, or parts in order to improve equipment functioning, maintainability, reliability, and/or safety characteristics. Requirements and step-by-step procedures for accomplishment are published as Modification Instructions (MI). MIs are designated as either urgent or normal depending on the nature of the modification (MCO P4790.2)

modification; normal—A type of equipment modification accomplished according to a planned schedule which involves the alteration of an item to correct or improve its design, functioning, and maintainability. Normal modification instructions establish an effective date from which an activity has one year to complete the modification. Normal modification requirements generally do not resist the operating conditions of the item of equipment. (MCO P4790.2)

modification; urgent—A type of equipment modification required to prevent death or serious injury to personnel, prevent major damage to equipment, or make changes which are considered so essential to equipment that their application must be accomplished at the earliest possible time. Urgent Modification Instructions specify a required completion date and may contain restrictive operating conditions. Instructions restricting operation conditions may be disseminated by message. (MCO P4790.2)

N

National Stock Number—The 13-digit stock number replacing the 11-digit Federal Stock Number. It consists of the 4-digit Federal Supply Classification code and the 9-digit National Item Identification Number. The National Item Identification Number consists of a 2-digit National Codification Bureau number designating the central cataloging office of the NATO or other friendly country which assigned the number and a 7-digit (xxx-xxxx) nonsignificant number. The number shall be arranged as follows: 9999-00-999-9999. (Joint Pub 1-02)

nonreparable items—Items which, after a period of use, cannot be economically restored to a serviceable condition (usually expendable types of supplies and materiel). (MCO P4400.150)

O

on hand—The quantity of an item that is physically available in a storage location and contained in the accountable property book records of an issuing activity. (Joint Pub 1-02)

operational logistics—Operational logistics addresses sustainment within a military theater of operations. It connects the logistic efforts of the strategic level with those of the tactical level. . . . It makes them available in sufficient quantities to the tactical commander to support the concept of operations. Operational logistics involves those support activities required to sustain campaigns and major operations. It normally encompasses three tasks: providing resources to the tactical commanders, procuring resources not provided by strategic logistics, and managing the resources necessary to sustain the campaign in accordance with the intent of the operational-level commander. (MCDP 4)

operational readiness—The capability of a unit/formation, ship, weapon system or equipment to perform the missions or functions for which it is organized or designed. May be used in a general

sense or to express a level or degree of readiness. (Joint Pub 1-02)

operational readiness float—A pool of mission-essential, maintenance significant end items used to provide replacement items for unserviceable, reparable end items which cannot be repaired in time to meet an operational commitment. (FMFRP 0-14)

organizational maintenance—That maintenance which is the responsibility of and performed by a using organization on its assigned equipment. Its phases normally consist of inspecting, servicing, lubricating, adjusting, and the replacing of parts, minor assemblies, and subassemblies. (Joint Pub 1-02)

overhaul—The restoration of an item to a completely serviceable condition as prescribed by maintenance serviceability standards. See **rebuild**; **repair**. (Joint Pub 1-02)

P

part—An item forming part of an assembly or subassembly, which is not normally further broken down. (Joint Pub 1-02, NATO definition)

part number—A combination of numbers, letters, and symbols assigned by a designer, a manufacturer, or vendor to identify a specific part or item of materiel. (Joint Pub 1-02)

petroleum, oils, and lubricants—A broad term which includes all petroleum and associated products used by the Armed Forces. Also called POL. (Joint Pub 1-02)

pre-expended bin—Low-cost, fast-moving consumables held by maintenance shops that are replenished on a recurring basis and expended upon issue from the consumer inventory. (MCO P4400.150)

preventive maintenance—The care and servicing by personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects. (Joint Pub 1-02)

principal items—End items and replacement assemblies of such importance that management techniques require centralized individual item management throughout the supply system, to include depot level, base level, and items in the hands of using units. These specifically include the items where, in the judgment of the Services, there is a need for central inventory control, including centralized computation of requirements, central procurement, central direction of distribution, and central knowledge and control of all assets owned by the Services. (Joint Pub 1-02)

principal end item—A Marine Corps-unique term synonymous with principal item. (MCO P4400.150)

R

rebuild—The restoration of an item to a standard as nearly as possible to its original condition in appearance, performance, and life expectancy. See **overhaul**; **repair**. (Joint Pub 1-02)

recoverable item—An item which normally is not consumed in use and is subject to return for repair or disposal. (Joint Pub 1-02)

recoverable item program—The program that establishes policy and procedures for the recovery, reporting, and management of recoverable items which cannot be repaired within the resources available to the field commander, become excess to a command's allowances, or which are beyond economical repair and require disposal.

repair—The restoration of an item to serviceable condition through correction of a specific failure or unserviceable condition. See **overhaul**; **rebuild**. (Joint Pub 1-02)

repair cycle—The stages through which a reparable item passes from the time of its removal or replacement until it is reinstalled or placed in stock in a serviceable condition. (Joint Pub 1-02)

reparable item—An item that can be reconditioned or economically repaired for reuse when it becomes unserviceable. See **recoverable item**. (Joint Pub 1-02)

requisition—1. An authoritative demand or request especially for personnel, supplies, or services authorized but not made available without specific request. **2.** To demand or require services from an invaded or conquered nation. (Joint Pub 1-02)

S

salvage—1. Property that has some value in excess of its basic material content but which is in such condition that it has no reasonable prospect of use for any purpose as a unit and its repair or rehabilitation for use as a unit is clearly impractical. **2.** The saving or rescuing of condemned, discarded, or abandoned property, and of materials contained therein for reuse, refabrication, or scrapping. (Joint Pub 1-02)

scheduled maintenance—Periodic prescribed inspection and/or servicing of equipment accomplished on a calendar, mileage, or hours of operation basis. See **organizational maintenance**. (Joint Pub 1-02)

secondary reparable items—End items and expendable and reparable items other than principal end items.

selective interchange—The exchange of selected serviceable repair parts/components from a deadlined item of equipment for unserviceable repair parts/components from a like item. The exchange must be complete to qualify as selective interchange. The exchange, however, may take the form of a requisition for the replacement repair part/component in lieu of the actual unserviceable repair part/component. (MCO P4790.2)

standing operating procedure—A set of instructions covering those features of operations which lend themselves to a definite or standardized procedure without loss of effectiveness. The procedure is applicable unless ordered otherwise. Also called standard operating procedure. (Joint Pub 1-02)

subassembly—In logistics, a portion of an assembly, consisting of two or more parts, that can be provisioned and replaced as an entity. See **assembly**; **component**; **part**. (Joint Pub 1-02)

supplies—In logistics, all materiel and items used in the equipment, support, and maintenance of military forces. (Joint Pub 1-02)

supply—The procurement, distribution, maintenance while in storage, and salvage of supplies, including the determination of kind and quantity of supplies. **a. producer phase**—That phase of military supply which extends from determination of procurement schedules to acceptance of finished supplies by the Military Services. **b. consumer phase**—That phase of military supply which extends from receipt of finished supplies by the Military Services through issue for use or consumption. (Joint Pub 1-02)

T

table of authorized materiel (NAVMC 1017)—A source document of information for logistics planning with respect to selected materiel authorized for use by organizations, activities, and detachments of the Marine Corps, both regular and reserve. Items listed in the table of authorized materiel include the three supply-types of materiel, subsistence, and petroleum, oils, and lubricants. (MCO P4790.2)

table of equipment—A document listing the equipment which a unit is required to possess and maintain in order to accomplish its mission. When used with the table of organization, it serves as the basis for determining what publications and additional equipment may be required by the unit. (MCO P4790.2)

table of organization—A document which provides the authority for personnel staffing of a unit and the basis for all other resources. The table of organization contains a unit's mission, organization, concept of employment, administrative capabilities, and logistics capabilities. (MCO P4790.2)

technical assistance—The providing of advice, assistance, and training pertaining to the installation, operation, and maintenance of equipment. (Joint Pub 1-02)

turnover folder—A folder containing information about policy, personnel, status of pending projects, references, management controls, functioning of a section, and ways and means of accomplishing routine as well as infrequent tasks, and any other information of value to an individual newly assigned to a billet. (MCO P4790.2)

U

unserviceable—An item in a condition unfit for use, but which can be restored to a serviceable condition after repair, rework, or overhaul. (MCO P4400.150)

Appendix E

References and Related Publications

Joint Publications (Joint Pubs)

1-02	Department of Defense Dictionary of Military and Associated Terms
3-08	Interagency Coordination During Joint Operations
3-10	Joint Doctrine for Rear Area Operations
4-0	Doctrine for Logistic Support of Joint Operations

Marine Corps Publications

Marine Corps Doctrinal Publication (MCDP)

1	Warfighting
4	Logistics

Marine Corps Warfighting Publication (MCWP)

4-1	Logistics Operations (under development)

Fleet Marine Force Reference Publication (FMFRP)

0-14	Marine Corps Supplement to the DOD Dictionary of Military and Associated Terms
4-34	Recovery and Battlefield Damage Assessment and Repair (when reissued, will become MCRP 4-24A, same title)

Marine Corps Orders (MCOs)

P1200.7	Military Occupational Specialties (MOS) Manual
3000.2	Operational Reporting
3000.11	Marine Corps Ground Equipment Resource Reporting (MCGERR)
4400.16	Uniform Material Movement and Issue Priority System (with changes 1–3)
P4400.82	Marine Corps Unified Materiel Management System (MUMMS) Control Item Management Manual (with change 1)
P4400.150	Consumer Level Supply Policy Manual (with changes 1–3)
4710.8	Uniform Criteria for Repair Cost Estimates Used in Determination of Economic Repair
4731.1	The U.S. Marine Corps Oil Analysis Program
4733.1	Marine Corps Test, Measurements, and Diagnostic Equipment Calibration and Maintenance Program

P4790.1	Marine Corps Integrated Maintenance Management System (MIMMS) Introduction Manual (with changes 1 and 2)
P4790.2	MIMMS Field Procedures Manual (with change 1)
4790.18	Corrosion Prevention and Control Program
4855.10	Quality Deficiency Reporting
5100.8	Marine Corps Ground Occupational Safety and Health (OSH) Program
5210.11	Records Management Program for the Marine Corps (with changes 1 and 2)
5214.2	Marine Corps Information Requirements Reports
P5215.1	The Marine Corps Directive System
P5215.17	Marine Corps Technical Publications System Manual
5216.9	HQMC Organization and Organization Codes
P5600.31	Marine Corps Publications and Printing Regulations (with change 1)
6260.1	Marine Corps Hearing Conservation Program
P7000.14	Marine Corps Cost Factors Manual
P7100.8	Field Budget Guidance Manual
8010.1	Class V(W) Supply FMF Combat Operations
P8011.4	Marine Corps Table of Allowances for Class V (W) Materiel (Peacetime)
11240.19	Repair Parts for Motor Transport Tactical Vehicles
11240.84	Wheeled Tactical Motor Transport Vehicle Maintenance Expenditure Limits (with change 1)
11262.2	Inspection and Load-Testing of Marine Corps-Owned Commercial and Tactical Load-Lifting Equipment

Marine Corps Bulletins (MCBuls)

3000	Table of Marine Corps Ground Equipment Resource Reporting (MCGERR) Equipment
5214 series	Information Requirements Management in the Marine Corps
4790	Maintenance Management of Marine Corps Class VIII Equipment

Technical Manuals (TMs)

08594A-10	Light Armored Vehicle LAV-25
3080.12	Corrosion Control G/Equipment
4700-15/1	Ground Equipment Record Procedures
6625-45/4	Automotive Test Equipment Operation and Calibration
8000-10/1	Ordnance Characteristics Manual
9130-12	Fuel Handling Procedures (Liquid Fuels)
11275-15/3	Principal Technical Characteristics of Marine Corps Engineer Equipment

Users Manuals (UMs)

UM-MCPDS	Marine Corps Publications Distribution System (MCPDS) Users Manual
UM-PLMS	Marine Corps Publications Library Management System (PLMS) Users Manual

Marine Corps Technical Instructions (TIs)

2005-25/2	Postsubmersion Salvage Procedures Electronic Equipment
4710-14/1	Replacement and Evacuation Criteria, USMC Equipment
4733-15/1	Calibration Requirements, Test, Measurement, and Diagnostic Equipment
4733-15/2	Sliding Calibration Interval Program, Test, Measurement, and Diagnostic Equipment

4733-15/7	Procedural Publications Index for Marine Corps Measurement and Diagnostic Equipment, Calibration and Maintenance Program
4733-15/10	Special Calibration of Torque Wrenches, Marine Corps Calibration Program
4733-35/5	Calibration Equipment Recommendations, Marine Corps Calibration Program
4733-35/6	Test, Measurement, and Diagnostic Equipment, Calibration and Maintenance Program
4733-35/8	Marine Corps Standards Exchange Program, Calibration and Maintenance Program
5600 Series	Publication Information, Marine Corps Equipment
6100-15/1	Neutralizing and Disposing of Storage Batteries Electrolyte
6850-13/2	Conservation Procedures Antifreeze Solutions
8005-34/18	Prepackaging Inspection for Serviceability Ordnance Materiel (with change 1)
8370-15/1	Identification Marking Small Arms

Users Manuals (UMs)

4400-124	SASSY Using Unit Procedures
4790-5	MIMMS Automated Information System Field Maintenance Procedures

Navy/Marine Corps (NAVMC) Departmental Publications

1017	Table of Authorized Materiel (TAM)
2599	A Guidebook for Commanders-Materiel Management
2664	Financial Guidebook for Commanders
2761	Catalog of Publications

Navy Publications

Naval Sea Systems Command Operating Procedures (NAVSEAOP)

2165	Navy Transport Safety Handbook (Volume 1) (with changes 1–5)

Office of the Chief of Naval Operations Instruction (OPNAVINST)

4790.2	The Naval Aviation Maintenance Program

Army Publications

Field Manual (FM)

101-10-1/2	Staff Officer's Field Manual: Organizational, Technical, and Logistical Data (with change 1)

Technical Manuals (TMs)

9-237	Operator's Manual for Welding Theory and Application
9-243	Use and Care of Hand Tools and Measuring Tools
10-8400-201-23	Unit and Direct Support Maintenance Manual for General Repair Procedures for Clothing (with changes 1–6)
11-486-11	Electrical Communications Systems Engineering: Definitions and Abbreviations

Works Cited

Chapter 1. Maintenance Overview

1. *Marine Corps Manual* (March 1980) pp. 4–13.

2. MCDP 4, *Logistics* (February 1997) pp. 42 and 43.

3. Joint Pub 1-02, *Department of Defense Dictionary of Military and Associated Terms.*

Chapter 2. Maintenance Management

1. FMFRP 12-14, *Logistics in the National Defense* (April 1989) p. 185.

Chapter 3. Maintenance-Related Programs

1. FMFRP 12-15, *Small Wars Manual* (April 1987) chap. II, p. 49.

Chapter 4. Maintenance Organizations

1. FMFRP 12-14, p. 294.

Chapter 5. Maintenance Planning

1. FMFRP 12-14, p. 78.

2. Ibid., p. 142.

Chapter 6. Maintenance Execution

1. FMFRP 12-14, p. 132.

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