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COMBAT AND TACTICAL VEHICLE MAINTENANCE IN THE ARMY, (U)  
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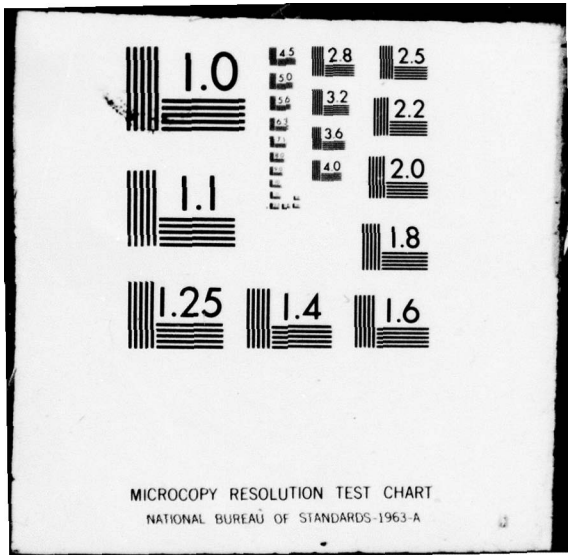
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6 COMBAT AND TACTICAL VEHICLE MAINTENANCE  
IN THE ARMY

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## EXECUTIVE SUMMARY

The purpose of this study was to appraise the capability and effectiveness of direct support (DS) and general support (GS) Army maintenance units and to recommend improvements. Principally, this appraisal focused on the capability of DS and GS maintenance units to satisfy wartime requirements.

The study focused on military maintenance units supporting tactical and combat vehicles in the U.S. Army Forces Command (FORSCOM), U.S. Army Europe (USAREUR), U.S. Army Reserve (USAR), and Army National Guard (ARNG).

### WARTIME CAPABILITY

Overall, DS units are capable of supporting the remove-and-replace tasks common at that level of maintenance. Several deficiencies, however, were observed in the capabilities of specific units, and those derived primarily from local maintenance support policies and practices.

All divisional maintenance battalions have peacetime support assignments consistent with planned wartime roles.

Nondivisional DS units in CONUS have extremely narrow peacetime missions. Most support only noncombatant units; they are not used in a division backup role. Mechanics assigned to these units are therefore exposed only to selected equipment. USAREUR DS units, on the other hand, have peacetime missions in which they support the full range of equipment that they may be required to maintain during wartime.

GS maintenance units are unprepared for war. They are not receiving the necessary training to effectively perform in the traditional GS-role of supporting the supply system or operating in a fix forward environment under a repair-and-return-to-user concept.

Many units do not have a GS peacetime mission. Those that do concentrate on easy-to-repair assemblies (primarily from tactical vehicles) and receive little training on tactical and combat vehicle end items. Most GS maintenance is performed by civilians in post maintenance shops in CONUS and foreign national activities in Europe.

Reserve Component units are incapable of supporting planned wartime missions. Even though current indicators show unit readiness ratings to be low, they do not accurately portray the extent of the weaknesses. Personnel shortages are usually cited as the principal cause of units not being fully capable, but the problems go beyond that limitation to include high personnel turnover, insufficient hands-on training, and lack of qualified personnel.

While the basic Army maintenance structure was not specifically reviewed, it appears to be sound. Most observed problems appear to result from maintenance practices adopted within that structure.

#### PEACETIME MECHANIC UTILIZATION

Military mechanics in CONUS and USAREUR are available for maintenance duties between four and five hours per day. Of this time, they perform actual maintenance tasks one to three hours per day; however, only a few units recorded productive utilization of more than two hours per day. (Most Army mechanics actually have a strong interest in spending considerably more time performing maintenance duties; they find diversions very discouraging.) Many factors contribute to these levels, but the dominant factor is the low priority given to mechanic utilization.

#### FUNDAMENTAL MAINTENANCE ISSUES

##### Maintenance Training

Training of mechanics is now, and will continue to be, the most important Army maintenance issue. The role of a maintenance unit in peacetime



is "training for wartime." Yet, in today's structure, production takes precedence over training. Field units have not established the on-the-job training (OJT) programs that are absolutely essential for mechanics who have received the minimum of school training. The need for enhanced maintenance training has not been recognized, especially for GS maintenance.

#### Reliance on Civilian Mechanics

The Army uses civilian maintenance organizations in a manner counterproductive to development of military mechanic skills. CONUS post maintenance organizations (civilian-staffed activities which provide maintenance support to all equipment on the post) have both a backup DS mission and the primary GS mission. The backup DS mission results in post maintenance assisting the military units through heavy workload periods and providing an easy evacuation channel for more complex DS tasks. Post maintenance dominates GS maintenance; military GS units have minor roles.

In USAREUR, the reliance on civilian mechanics for GS maintenance is especially pronounced. This is caused by funding practices which provide free GS and depot repairs, and by production and manpower pressures. As a result, foreign-national civilians perform the vast majority of GS maintenance for tactical and combat vehicles.

#### REQUIRED IMPROVEMENTS

The Army is developing three major programs which could influence its maintenance structure significantly: Restructured General Support, Logistics Operations in the Communications Zone, and the Support Unit Improvement Program. However, the changes in vehicle maintenance that these initiatives may bring will have little impact on unit capability, because none of those changes is directed at enhancing mechanic readiness. The following recommendations, if implemented, will improve the readiness of both Active Army and Reserve Component mechanics.

### DS Maintenance

The recommended changes to DS maintenance include eliminating backup DS roles for CONUS post maintenance activities and realigning the support missions for nondivisional units on CONUS posts. The mission realignments involve both revising installation support plans so nondivisional units provide DS maintenance to combatant units and transferring units to posts with better maintenance workload opportunities. These actions will result in military mechanics performing more maintenance on a wider variety of equipment.

### GS Maintenance

A Mechanic Enhancement Program should be developed, consisting of the following three phases.

Apprentice Training. All first-term school graduates scheduled for assignment to GS maintenance units would first serve as apprentices in CONUS post maintenance shops for approximately four months. During this period, the apprentice would rotate through various training stations under the supervision of experienced civilian mechanics. Apprentices would be relieved of nonmaintenance duties to fully concentrate on the development of mechanic skills.

All apprentices would be under the command of the senior officer of the post maintenance shop. Individual progress would be closely monitored; apprentices not progressing satisfactorily would be transferred out of the program.

Initial Field Assignment. Upon successful completion of apprentice training, the mechanic would be assigned to a GS unit. During this assignment, the mechanic would refine and enhance the skills learned in the classroom and the apprentice program. To ensure that the necessary workload

is available, FORSCOM and USAREUR will need to take several actions, including the realignment of GS missions and establishment of specific unit workloads.

Advanced Technician Training. Upon reenlistment, GS mechanics would be reassigned to post maintenance shops for four months of advanced technician training. During this period, inspection, diagnostics, and other advanced maintenance tasks would be emphasized. After completion of advanced technician training, the mechanic would be assigned to a key maintenance position in a GS unit.

Baseline for Reserve Components

As a first step to improving the capability of Reserve Component maintenance units, we recommend that the Department of the Army undertake an independent, comprehensive evaluation of every USAR and ARNG maintenance unit. That evaluation should then serve as a basis for all future actions, including: (1) matching more capable units with the earliest deployment requirements, and (2) identifying where the Army should concentrate resources.

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## I. INTRODUCTION

### BACKGROUND

This report presents the results of work accomplished under Logistics Management Institute (LMI) Task ML804, "Effectiveness of Direct and General Support Maintenance Units in Army."

This task was initiated by the Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics) in lieu of conduct of Phase II of LMI Task 77-9, "Productivity of Organizational and Intermediate Maintenance." The latter study verified General Accounting Office and Army Audit Agency findings of low peacetime utilization of military mechanics assigned to Army direct support (DS) and general support (GS) maintenance units. It also identified several factors which influence peacetime mechanic utilization and questioned the capability of maintenance units to accomplish their wartime mission. These findings indicated a need for a broader investigation of Army maintenance, with a focus on unit capability and effectiveness.

### OBJECTIVES

The purpose of this study was to appraise the capability and effectiveness of Army DS and GS maintenance units and make recommendations for improvement. The specific objectives were to evaluate: (1) the capability of these units to satisfy wartime requirements, (2) the peacetime effectiveness of these units under the present Army structure, and (3) modifications to the Army maintenance structure presently under development or in use on a limited basis.

## SCOPE

The assessment focused on maintenance units primarily supporting tactical and combat vehicles. Active Component units in the U.S. Army Forces Command (FORSCOM) and the U.S. Army Europe (USAREUR) and Reserve Component (RC) units in the U.S. Army Reserve (USAR) and the Army National Guard (ARNG) were included in the assessment. The evaluation of capability considered units in both Active and Reserve Components; the evaluation of effectiveness included only Active Component units. The evaluation of modifications to the existing Army maintenance structure was aimed at assessing the impact of forthcoming changes which evolved from two recently completed Army studies: (1) Restructured General Support and (2) Logistics Operations in the Communications Zone.

The types of maintenance units that were examined include:

- Divisional Maintenance Battalion, DS (exclusive of the aircraft and missile companies)
- Maintenance Company, Forward, DS
- Maintenance Company, Rear, DS
- Maintenance Company, Theater Army Support Command (TASCOM), DS
- Heavy Equipment Maintenance (HEM) Company, GS
- Light Equipment Maintenance (LEM) Company, GS

## METHODOLOGY

### Unit Capability

The assessment of DS and GS unit capability focused on the maintenance portion of their wartime requirements. While other requirements, such as parts control or the unit's ability to defend itself, are critical during wartime, they were not central to the interpretation given unit capability. For the purpose of this study, unit capability is defined as the ability of the unit to perform maintenance tasks consistent with its Table of Organization and Equipment (TOE) mission. This is not the long-term ability, as

almost any unit can be made fully capable given adequate training, facilities, tools, test equipment, and time. Rather it is the ability to perform in the short term. Therefore, the primary indicator of unit capability was the "demonstrated ability to fully support TOE mission equipment."

The methodology for assessing unit capability varied between Active and Reserve Component units and also between DS and GS units. The peacetime repair performance for Active Army units was compared with their TOE missions. When apparent deficiencies were observed, then use of on-the-job training (OJT) programs to compensate for the deficiency was examined.

For Active Army units, the evaluation of DS capability was based on the end items maintained and the component direct exchange (DX) repair program. The situation for GS units is far more complex. Their TOE mission includes such a wide range of components, assemblies, and end items that it is almost impractical for any one unit to obtain extensive experience supporting all of these requirements. Thus, the assessment of Active Army GS unit capability focused primarily on their component/assembly repair programs.

In the Reserve Components, the assessment of unit capability had to extend beyond a review of production schedules, equipment being supported, and training programs. Obviously, the production and training opportunities differ widely between units on full-time duty and those on part-time duty. Thus, it was necessary to consider several additional indicators in evaluating the capability of RC units. Included as additional indicators were personnel strengths and turnover, number of qualified mechanics, and hands-on training opportunities.

#### Unit Effectiveness

The role of a maintenance unit during peacetime is essentially "training for wartime." As in many other training areas, hands-on training is



necessary; it also has the potential to generate a considerable capacity for maintaining equipment. Yet, the low peacetime utilization of military mechanics, as identified in several prior studies, results in reduced maintenance training and an increased requirement for maintenance to be performed by civilian mechanics.

Thus, the evaluation of unit effectiveness focused on (1) how well mechanics assigned to maintenance units are being utilized, and (2) ways in which these mechanics can be used more productively--either for added training or production.

#### STRUCTURE

The task was partitioned into five subtasks:

- maintenance manpower requirements determination
- training of military mechanics
- capability and effectiveness of CONUS units
- capability and effectiveness of USAREUR units
- capability of USAR and ARNG units

At the conclusion of each subtask, an informal working paper was prepared. The first working paper, "Maintenance Manpower Requirements Determination," addressed the TOE development process for maintenance units. The second working paper, "Training of Military Mechanics," provided an overview of maintenance training and its impact on unit capability. This paper was followed by "Capability and Effectiveness of CONUS Units," and "Capability and Effectiveness of USAREUR Units." These two working papers presented findings on the capability and effectiveness of DS and GS maintenance units in CONUS and USAREUR. The last working paper, "Capability of USAR and ARNG Units," addressed the capability of Reserve Component maintenance units. A synopsis of each of these working papers may be found in the appendices.

## ORGANIZATION OF THE REPORT

The working papers developed during the course of this task contain extensive information, discussion, and observations on unit capability and effectiveness. That level of detail is not contained in this report. If specific information is desired, the reader may refer to the individual working papers.

The remainder of this report contains four chapters. The next chapter describes the levels of vehicle maintenance and the maintenance support structures in CONUS, USAREUR, and the Reserve Components. That chapter establishes a foundation for the balance of the report. In Chapter III, a summary of the overall condition of combat and tactical vehicle maintenance within the Army is presented. This summary encompasses all five subtasks, but focuses on the most important aspects of vehicle maintenance. Chapter IV discusses significant changes planned for Army maintenance. In that chapter, several forecasts on the status of Army maintenance during the 1980s are developed. The last chapter identifies several specific actions that can be taken to improve the capability and effectiveness of Army DS and GS maintenance units.

## II. OVERVIEW OF ARMY MAINTENANCE

### LEVELS OF MAINTENANCE

Maintenance in the Army is performed at four levels:

- organizational
- direct
- general
- depot

Organizational maintenance encompasses minor adjustments to readily accessible mechanical and electrical systems and replacement or alignment of easily accessible unserviceable parts such as fan belts, brake shoes, and tires. This level of maintenance is performed by military mechanics assigned to company or battalion motor pools. Organizational maintenance capability is integral to all military units with a significant amount of authorized equipment.

Direct support maintenance primarily involves diagnosis and isolation of equipment malfunctions and replacement of defective components such as engines, transmissions, and compressors. Some component disassembly and light body repairs are also authorized. DS maintenance is usually performed by divisional maintenance battalions or nondivisional companies in support of specifically identified military units. Components and end items repaired by these battalions and companies are returned directly to the user. DS units are generally TOE-staffed.

General support maintenance includes diagnosis and isolation of equipment malfunctions at the piece-part level, repair of defective components by grinding/adjusting such items as valves and tappets, and performing heavy

body repairs to major end items. GS maintenance on components is primarily in support of the supply system, while major end items are usually returned directly to the user. GS maintenance units may be either military (i.e., a TOE unit) or civilian (i.e., a Table of Distribution and Allowances (TDA) unit).

Depot maintenance encompasses overhaul of end items and components, and repair of items that exceed the capability of lower-level maintenance organizations. It is also authorized when close tolerances must be met or special environmental facilities required. Depots support the supply system by restoration of unserviceable assets to prescribed levels of serviceability and by modernization of serviceable assets. All depots are TDA organizations.

The relationship of the four levels is straightforward. If maintenance is required on a particular piece of equipment, it is sent to the organizational motor pool. If the required maintenance is beyond the capability or capacity of the motor pool, the equipment is then evacuated to a DS unit, or possibly to a GS unit. Then, if the required maintenance exceeds the capability or capacity of the DS unit, the equipment is "evacuated" (consigned) to a GS unit. Finally, if the repairs cannot be accomplished at the GS level, the equipment is evacuated to a depot.

#### MAINTENANCE STRUCTURE IN CONUS

Within CONUS, TOE DS and GS maintenance units are assigned to either U.S. Army Training and Doctrine Command (TRADOC) or FORSCOM installations.

The maintenance support structure at TRADOC installations is relatively simple. Each installation has a TDA post maintenance activity, and several posts also have TOE maintenance units assigned to support FORSCOM units on the post. Both the FORSCOM units and the TRADOC training centers receive DS/GS



maintenance support from either the TOE units or the post maintenance activity.

The maintenance structure at FORSCOM installations is somewhat more complex, particularly at posts that support a division. On these posts, DS maintenance for division equipment is provided by the divisional maintenance battalion, part of the division support command (DISCOM). The equipment is evacuated to the maintenance battalion from organizational motor pools located throughout the division. Other combat, combat support, and combat service support units assigned to the installation receive DS maintenance from non-divisional units, such as DS forward or rear companies in nondivisional maintenance battalions or support groups. If a TOE GS unit is located on the installation, it can provide backup DS to both divisional and nondivisional DS companies, along with its normal GS mission. The post maintenance activity provides backup DS to all maintenance units on the installation. It also has the dominant GS mission on the post.

Two installations--Fort Bragg and Fort Hood--also have a corps headquarters collocated with a division. As elsewhere, the divisional maintenance battalion provides DS maintenance for division equipment. However, a corps support command (COSCOM) is charged with providing DS and GS maintenance for all assigned nondivisional units.

#### MAINTENANCE STRUCTURE IN USAREUR

##### Support Organization

Responsibility for maintenance is divided between divisional and nondivisional organizations. As with CONUS divisions, each USAREUR division is supported at the DS level by a divisional maintenance battalion within the



DISCOM. Nondivisional maintenance support is divided on a geographic basis among four major commands:

- V Corps
- VII Corps
- 21st Support Command (SUPCOM)
- 7th Army Training Command (ATC)

Each command has maintenance responsibility for all units located in its area. Figure II-1 delineates the area supported by each command.

In the V and VII Corps areas, responsibility is divided between the DISCOMs for divisional support and the COSCOMs for nondivisional support. The COSCOM is responsible for all DS to nondivisional units, backup DS to the divisions, and GS for all units. Each COSCOM has three area support battalions (ASB) which provide the actual maintenance support. Each divisional maintenance battalion is supported by a specific ASB. These organizational relationships, which are identical for each corps, are depicted in Figure II-2.

The 21st SUPCOM provides DS and GS maintenance to all units in its area and backup GS for both COSCOMs. The 21st SUPCOM has two ASBs and operates three specialized repair activities (SRAs) which perform GS maintenance.

The 7th ATC has support responsibility for units training in its area. However, maintenance units often accompany combat units to the 7th ATC area so the extent of maintenance support by the 7th ATC is limited.

As a guide, USAREUR has developed a standard ASB which has four vehicle maintenance companies of three different types: two Area Maintenance Companies, DS; one Area Maintenance Company, GS; and one Collection, Reclamation, and Exchange (CRE) Company, GS. In practice, subordinate commands

FIGURE II-1. USAREUR AREA SUPPORT RESPONSIBILITIES

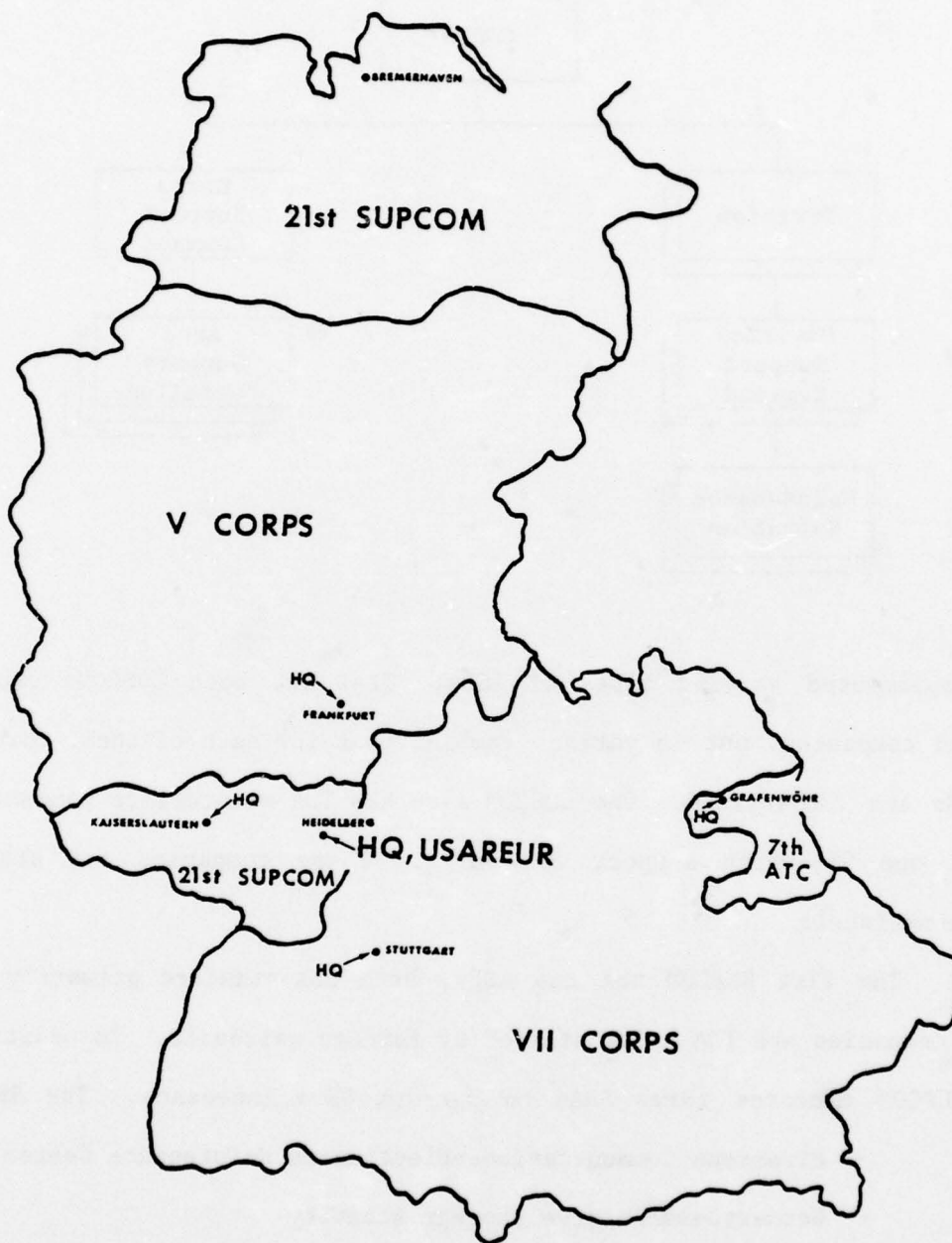
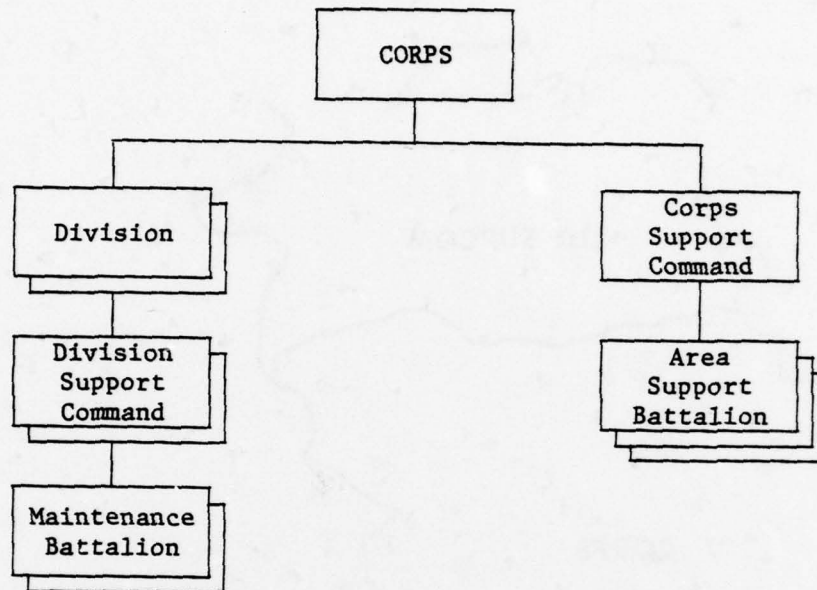


FIGURE II-2. CORPS MAINTENANCE SUPPORT ORGANIZATION



have implemented varying types of ASBs. That is, both COSCOMs employ the standard companies, but in various combinations for each of their three ASBs. The ASBs are TOE-staffed. One COSCOM also has TDA maintenance companies--two DS and one GS--which support TOE units. These companies are staffed by foreign nationals.

The 21st SUPCOM has two ASBs, both non-standard primarily because the GS companies are TDA units staffed by foreign nationals. In addition, the 21st SUPCOM operates three SRAs to perform GS maintenance. The SRAs are:

- Pirmasens Communications-Electronics Maintenance Center
- Germersheim Reserve Storage Activity
- Kaiserslautern Army Depot

These facilities were established when most of USAREUR's maintenance depots were closed. The SRAs are TDA organizations staffed by foreign nationals.

### Theater-Level GS Repair Program

The USAREUR Materiel Management Center (UMMC), an extension of the USAREUR Office of the Deputy Chief of Staff, Logistics, is responsible for the Theater Army Repair Program (TARP). The TARP is a USAREUR-wide GS-level repair program in support of the supply system. It encompasses components, assemblies, and end items over a wide range of equipment including combat and tactical vehicles, communications-electronics, construction, and general equipment.

Most of the TARP workload is performed by the SRAs and other foreign-national-staffed TDA units within the 21st SUPCOM. The SRAs are almost exclusively dedicated to support of the TARP. The UMMC also negotiates with the 21st SUPCOM and the COSCOMs for excess GS capacity which might be available after these organizations have programmed their own GS mission work.

### Planned Wartime Maintenance Responsibilities

During wartime, DS maintenance for the divisions will be provided by the divisional maintenance battalions.

The organization for backup maintenance support of the divisions and for support of nondivisional units is more complex. Every divisional maintenance battalion will receive backup support from an ASB, which will become part of a corps forward support group. The corps forward support group will be comprised of both DS and GS units. In addition to providing GS and backup DS, the GS units will also support a fix forward mission. The purpose of this mission is to conduct battlefield diagnosis and cannibalization for component replacement in order to quickly restore unserviceable end items to an operationally ready condition.

In the corps rear area, a corps rear support group will be formed from nondivisional DS and GS maintenance battalions. These battalions will be filled out from early-deploying Active Army CONUS units.



In the communications zone (COMMZ), maintenance support will be provided by nondivisional DS and GS maintenance battalions. Their missions will include support for units in the COMMZ and GS repair of corps overflow. The COMMZ maintenance battalions will be organized from existing units of the 21st SUPCOM, Reserve Component units, and late-deploying Active Army units.

#### MAINTENANCE STRUCTURE IN THE RESERVE COMPONENTS

During peacetime, military maintenance units in the Reserve Components train for their wartime mission. Because of this emphasis and their part-time status, these units generally do not have a maintenance mission per se. Nonetheless, RC equipment must be maintained at a high state of readiness. This is the responsibility of full-time civilian-staffed activities.

Since the USAR and ARNG have different structures for satisfying both the maintenance unit training and equipment maintenance missions, each Component is separately discussed.

#### U.S. Army Reserve

Maintenance Unit Training. The Department of the Army (DA), through the Office of the Chief of Army Reserve, has overall responsibility for the USAR. FORSCOM is responsible for the training and readiness of the USAR. Much of FORSCOM's responsibility has been delegated to the three Continental U.S. Armies (CONUSAs). These armies have responsibility for a specific geographic area of CONUS. The CONUSAs, through a full-time staff, provide guidance to Major U.S. Army Reserve Commands (MUSARCs), which carry out day-to-day administration, training and preparedness activities.

There are two types of MUSARCs: Army Reserve Commands (ARCOMs) and General Officer Commands (GOCOMs). Within a CONUSA, most MUSARCs have specific geographic areas of responsibility although a few are both functionally and geographically aligned. All are staffed with full-time

personnel, while subordinate TOE organizations are staffed primarily with Reservists in a part-time training status.

The ARCOMs are TDA organizations not subject to mobilization. The subordinate TOE units (e.g., support groups, battalions, and companies) may be deployed and would be attached to standard TOE combat service support organizations.

The GOCOMs are TOE organizations subject to mobilization, though not necessarily as a unit. In some cases, just the GOCOM headquarters would mobilize and deploy. Most of the subordinate TOE organizations (e.g., support groups, battalions, and companies) would deploy separately and be attached to other commands. There are several types of GOCOMs: support brigades, military police brigades, hospitals, and engineer brigades.

USAR TOE maintenance companies are located throughout CONUS under various MUSARCs. Logistically oriented MUSARCs (e.g., support brigades and COSCOMs) may be assigned several maintenance companies of various types. Other MUSARCs have no maintenance companies. Maintenance companies are frequently under the control of a maintenance battalion or a maintenance-oriented field depot. However, some maintenance companies are assigned to nonmaintenance-oriented organizations.

The CONUSAs also provide staff advice and assistance directly to units but outside command channels. Each CONUSA is geographically divided into several Army Readiness Regions (ARRs), which are further subdivided into Readiness Groups (RGs). The ARRs and RGs are both staffed with full-time Active Army advisors in various specialties, including maintenance. Both the RG advisors, and the ARR advisors to a lesser extent, visit units on a regular

basis. The purpose of these visits is to provide assistance in training and administration. There is no management authority vested in the ARRs and RGs.

Equipment Maintenance. Organizational maintenance support for USAR equipment is provided by Area Maintenance Support Activities (AMSAs), which are TDA organizations.<sup>1</sup> Each AMSA has specific USAR units to support. The AMSAs are located throughout CONUS under the management control of the ARCOMs. AMSA employees are full-time DA civilians who are required to be military members of a USAR unit, though not necessarily in a maintenance position.

Equipment repair beyond the capability or capacity of an AMSA is evacuated to a predetermined TDA post maintenance activity located on a FORSCOM or TRADOC post. Equipment is repaired and returned to the user. If the equipment cannot be repaired by the post maintenance activity, it is evacuated to a depot.

#### Army National Guard

Maintenance Unit Training. ARNG units have both a state mission (i.e., protection and safety of the citizenry) and a federal mission (i.e., preparation for mobilization in a national emergency). Maintenance unit training, in peacetime, is conducted within the organization for the state mission. That organization is similar among the states.

The governor of each state is commander-in-chief, but on a day-to-day basis, the state ARNG is under the control of the state adjutant general (AG). Below the AG are the standard divisional and nondivisional forces. Military operations follow the military command structure within the state; i.e., divisional maintenance battalions are under the control of DISCOMs (eight states are headquarters for ARNG divisions) and nondivisional companies

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<sup>1</sup>Some AMSAs perform limited DS maintenance.



are under the control of nondivisional maintenance battalions, reporting to support groups.

For the federal mission, the ARNG is subject to several organizational influences superimposed upon the state organization. The National Guard Bureau (NGB), a unique staff organization in the DA, provides staff support to the ARNG.<sup>2</sup> This role is necessary because: (1) the ARNG is mostly federally funded and equipped, and (2) the ARNG must follow organizations and procedures that are compatible with the U.S. Army. The NGB guides the states by issuing policies and regulations which appear to have the force of controlling documents. In fact, however, the NGB has no actual control over the ARNG. Under FORSCOM, the CONUSAs also provide guidance and assistance to the ARNG. This is limited to various inspections, scheduling of annual training, and evaluation of annual training effectiveness. The services of the ARRs and RGs are also available to ARNG units, but visits by advisors from these organizations are limited to occasions when the unit requests assistance.

Equipment Maintenance. Organizational maintenance support for ARNG equipment is provided by Organizational Maintenance Shops (OMSs), which are TDA organizations. Each OMS has specific ARNG units to support. Equipment repair beyond the capability or capacity of the OMS is evacuated to state-operated DS/GS facilities. These TDA facilities are usually Combined Support Maintenance Shops (CSMS), but other ARNG TDA facilities may also be used. Equipment is repaired and returned to the user. Repairs beyond the capability of the DS/GS facilities are evacuated to U.S. Army depots.

Within each state, maintenance operations are controlled by the AG through a state maintenance officer (SMO). The SMO has control over all

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<sup>2</sup>Technically, the NGB is a joint bureau of the Department of the Air Force and the DA.



organizational and DS/GS maintenance facilities. Each of these are staffed by full-time DA civilians who must belong to ARNG TOE units in positions comparable to their civilian positions.

### III. PRESENT CONDITION OF ARMY MAINTENANCE

#### BACKGROUND

Table III-1 shows the Active and Reserve Component maintenance units visited during this study.

For Active Army units, a wide variety of performance data was collected and analyzed. In some cases, evaluation of capability centered on an analysis of unit production; in other cases, the focus was on the maintenance workload evacuated to backup units. When maintenance production opportunities were limited, then actions to offset that deficiency were examined. Mechanic diversion and productivity data were collected wherever available.

For RC units, data collection and analysis extended beyond a review of maintenance task performance to include additional indicators such as personnel strengths and turnover, number of qualified mechanics, and hands-on training opportunities.

#### RECENT ARMY ACTIONS

##### Mechanic Training

The training of Army mechanics is accomplished in two phases: institutional and field. Most institutional training takes place in formal classrooms at TRADOC schools. Field training occurs at assigned duty stations, mostly through OJT programs.

Advanced Individual Training (AIT). AIT is given to Army personnel upon completion of their basic training course. Graduates of AIT are considered entry-level mechanics (i.e., skill level 10). Current training doctrine, effective at the end of fiscal year 1976, dictates that instruction be limited to those critical tasks which: (1) cannot be effectively learned

TABLE III-1. FIELD UNITS VISITED

Type of Unit	CONUS		USAREUR		USAR		ARNG	
	Total Units	Number Visited	Total Units	Number Visited	Total Units	Number Visited	Total Units	Number Visited
<u>Divisional Battalions</u>								
Infantry	3	1	-	-	-	-	5	2
Infantry (Mechanized)	3	2	2	1	-	-	1	1
Armored	2	2 <sup>a</sup>	2	1	-	-	2	1
Subtotal	8	5	4	2	-	-	8	4
<u>Nondivisional DS Companies</u>								
Forward	9	3	-	-	8	4 <sup>c</sup>	28	6 <sup>c</sup>
Rear	4	1	16	4	6	2	4	1
TASCOM	2	2	-	-	3	1	15	5
Subtotal	15	6	16	4	17	7	47	12
<u>Nondivisional GS Companies</u>								
HEM	5	4	-	-	4	3 <sup>c</sup>	36	4
LEM	1	1	-	- <sup>b</sup>	11	6 <sup>c</sup>	4	1
Area	-	-	5	4 <sup>b</sup>	-	-	-	-
CRE	-	-	5	4 <sup>b</sup>	-	-	-	-
Subtotal	6	5	10	8	15	9	40	5
Total	29	16	30	14	32	16	95	21

<sup>a</sup>These units were not actually visited, but some unit performance data were included in the analyses.

<sup>b</sup>Only three of each were visited, but unit performance data for all were included in the analyses.

<sup>c</sup>All but one of these units were actually visited, but data for all units are included in the analyses.

elsewhere, (2) are necessary for personnel safety, and (3) avoid equipment damage. The balance of the training is to be obtained either through field training programs or self-study.

The decision to limit AIT instruction to selected critical tasks was made for several reasons, primarily the high cost of institutional training. However, that decision placed a considerable burden on field maintenance units to develop a comprehensive OJT program for teaching tasks not covered during AIT.

Field Training. To assist field units with their OJT burden, TRADOC developed a series of manuals. These specify the maintenance skills necessary for functioning in a particular Military Occupational Specialty (MOS) at a given skill level. They also provide a means for reviewing and monitoring individual progress.

One of the measures used to determine mechanic competence (and thereby eligibility for promotion) is the mechanic's score on the Skill Qualification Test (SQT). The MOS manuals provide a framework for SQT preparation which, if properly used, should assure a good score. In fact, one of the objectives of field OJT programs is to assist mechanics in passing the SQT.

The OJT burden is particularly substantial in a maintenance unit because of the number of different MOSs in these units. To illustrate, MOS characteristics are displayed in Table III-2 for 4 units: 2 DS maintenance companies and 2 combat battalions. The table shows that the rear DS company has 34 maintenance MOSs, of which 24 are low density (i.e., less than 5 authorized positions). A tank battalion, in contrast, has 9 mission MOSs, of which 2 are low density.



TABLE III-2. MOS CHARACTERISTICS

Type of Unit	Total Strength	No. of MOSs	Mission MOSs	Low Density MOSs
Tank Battalion	571	29	9	2
Infantry Battalion (Mech.)	865	31	12	3
Forward Co., DS	215	48	21	14
Rear Co., DS	273	60	34	24

These representative MOS data indicate a significant OJT burden upon unit leadership. Each MOS has a different curriculum--the breadth and depth further extended by reduced institutional training. The successful satisfaction of this OJT requirement may not be a practical expectation in the light of the total responsibilities and duties of maintenance units. In fact, a comprehensive OJT program was not observed in any unit.

Downgrading of Grade/Skill Level

Since 1975, the U.S. Army Military Personnel Center (MILPERCEN) has been downgrading direct labor mechanic positions. Prior to this, maintenance unit TOEs were composed primarily of mechanics who possessed skill levels 20 or 30. Now, more than 65 percent of all TOE direct labor mechanic positions call for skill level 10. Since the number of maintenance supervisor positions in these units remained approximately the same, the ratio of entry level mechanics to supervisors increased dramatically. Table III-3 illustrates the effect of the increased proportion of skill level 10 mechanics in two companies.

TABLE III-3. DISTRIBUTION OF SUPERVISORS AND DIRECT LABOR MECHANICS

Type TOE	TOE Issue Dates	Number of Mechanics	Skill Level 10 Mechanics		Number of Maintenance Supervisors	Ratio: Skill Level 10 Supervisors
			No.	Pct.		
TOE 29-28H: Heavy Maint. Co., Maint. Bn., Inf. Division, Mechanized	Original - Nov. 1970	168	32	19%	13	2.5
	Latest - Mar. 1977	145	100	69%	13	7.7
TOE 29-427H: Maint. Co., DS, Theater Army Support Command	Original - Nov. 1974	171	14	8%	18	0.8
	Latest - Sep. 1977	131	105	89%	11	9.5

Impact of Recent Actions

TRADOC and MILPERCEN appear to be working in opposing directions in regard to mechanic grades and skill levels. Increased dependence upon lower-graded mechanics implies additional training requirements to assure that mechanic school graduates could accomplish the level of work ascribed to skill level 10. However, while MILPERCEN was establishing the need for increasing skill requirements at the lower levels, TRADOC was minimizing the institutional role in mechanic training. Thus, less skilled graduates were sent to field units, thereby placing a greatly increased training burden upon the supervisors and the higher-skilled mechanics (i.e., the 20s and 30s). This situation is further compounded by the large number of different MOSs for which unique OJT programs must be implemented.

EFFECTIVENESS OF UNITS

Mechanic Availability

Overall, the data on the availability of CONUS mechanics was inconsistent. In USAREUR, where some reliable data were obtained, mechanic availability averages approximately 4½ hours per day.

In both CONUS and USAREUR, mechanic nonavailability is due to non-maintenance assignments, much to the displeasure of the mechanic. There is

little visibility as to the reasons for these assignments. Mostly, the non-available time is categorized under such broad items as detail and military training. Maintenance units in USAREUR are confronted with an added special requirement to support their military community. For the units reviewed, community support ranges from 12 to 20 percent. Thus, a typical mechanic spends 1½ hours every working day on this support.

#### Mechanic Utilization

Mechanic utilization rates were developed from the direct labor hours actually charged to specific jobs and the number of direct labor mechanic positions in the TOE.<sup>1</sup> The direct labor hours were taken from the production reporting system. Since several nondivisional units in CONUS did not have such system support, the utilization of mechanics assigned to these units was not estimated.

In CONUS, military mechanics average between 1 and 2 hours of direct productive time every 8-hour workday (from 11 to 26 percent). This is exclusive of indirect productive time such as setup and parts-chasing. A similar situation was observed in USAREUR. The range in direct productive time for USAREUR mechanics is from 13 to 37 percent, or from 1 to 3 hours per day. Although USAREUR maintenance units appear slightly more effective than CONUS units, only 5 of the 20 USAREUR units reported utilizing mechanics more than 2 hours per 8-hour workday.

#### Dominant Factor in Maintenance Effectiveness

Throughout both CONUS and USAREUR, unit readiness reporting dictates most maintenance practices. Thus, if high equipment readiness is reported by supported units, there is little pressure on the maintenance organization to

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<sup>1</sup>For USAREUR units, the Modification TOE (MTOE) was used.



increase its effectiveness. According to the primary indicator of unit capability, the unit is already viewed as being highly effective.

It is frequently argued that low mechanic utilization results from: (1) the ease of evacuating work to backup units, (2) the retention of significant workload by post maintenance, even though TOE units have the mission, and (3) the heavy reliance upon the supply system for replacing components and assemblies rather than repairing them. These are not causes of low utilization; they are simply practices which enable equipment to be kept at a high level of readiness with minimal mechanic time in the shop.

A few unit commanders exhibited a strong interest in assuring the planned level of mechanic's skills of their maintenance personnel. In most units, however, mechanics are commonly treated simply as a manpower resource; if supported equipment is reported ready, there is little interest in their application to maintenance tasks.

#### DIRECT SUPPORT MAINTENANCE

##### Peacetime Maintenance Missions

All divisional maintenance battalions, both in CONUS and USAREUR, have peacetime support assignments consistent with their planned wartime role. For nondivisional units, however, the results are mixed.

Most CONUS nondivisional units have extremely narrow peacetime missions. The typical mission is to provide DS to nondivisional combat service support units on the post such as military police, hospital, and transportation companies. Rarely does a nondivisional DS maintenance company support a combatant unit directly or through a backup DS role. Thus, for example, the tracked vehicle, artillery, and turret mechanics assigned to these units seldom, if ever, have an opportunity to develop and exercise their skills.



Within USAREUR, the peacetime and wartime assignments for nondivisional units are consistent. They are assigned to either: (1) a COSCOM providing backup DS to divisions and DS to corps equipment, or (2) a SUPCOM providing backup DS to the corps and DS to units in the COMMZ. In some cases, however, the DS mission is incomplete. Two of the four units visited are not in the evacuation channel for combat vehicles and receive very little exposure to this type of equipment. Thus, the mechanics with combat vehicle related specialties are not receiving the necessary training.

The assignment of inconsistent peacetime/wartime missions is not a function of the basic maintenance doctrine; rather it stems from the application of that doctrine in a peacetime environment. While not specifically reviewed, we observed no major deficiencies in that doctrine.

#### Post or Command Practices

Even within the mission assignments discussed above, local post/command practices dictate the specific maintenance tasks assigned each unit.

Within CONUS, the influence of post maintenance is significant. DS units are frequently not supporting specific equipment or components even though they have the mission, mechanics, and facilities; that support is provided by post maintenance. The DX repair program is a typical example. Some nondivisional units do not repair any DX items; other DS units, including divisional battalions, routinely evacuate many DX items to post maintenance for repair. The underlying reasons for the nonsupport of DX and other equipment are not evident. Quite often it is because these items historically have been supported by post maintenance. In addition, there is a reluctance to assign complex, expensive equipment to young, inexperienced military mechanics. It is obvious, however, that there is: (1) a willingness on the part of the TOE unit (and higher elements) to allow post maintenance to do the

work, and (2) a strong interest by post maintenance to reinforce their continued presence on the post.

#### Unit Capability

The definition of DS unit capability used throughout the task was quite simple:

During peacetime, DS units should be routinely supporting the end items and components they will maintain during wartime; where mission differences exist, the units should have comprehensive training programs to compensate for the disparity.

Applying this definition to DS units in CONUS and USAREUR leads to the conclusion that when given the opportunity to routinely support combat and tactical vehicles, DS units are capable of maintaining the equipment of supported units through replacement (and some repair) of malfunctioning components and assemblies. This conclusion does not ascribe capability to all units and mechanics. (There are numerous, very challenging DS tasks which require extensive OJT to fully develop repair skills. Among these are failure diagnosis, fire control repair, and proper use of test equipment.) But the findings in this area do indicate that: (1) the basic repair skills and interest are inherent in DS units; (2) the tasks assigned to DS units are consistent with those skills and interest; and (3) where required, the enhancement of mechanic skills can be accomplished within the existing DS structure.

Previously, several inconsistent peacetime/wartime support missions were discussed. For the most part, the inconsistency is not of primary concern to maintenance officers. While some unit commanders expressed interest in broadening their workload, few were able to do so. There is also a widespread lack of support for the MOS manuals; not one unit could demonstrate that the manuals provided the framework for its maintenance training program. OJT programs, outside those resulting from normal production, do not exist.

Overall, there is no evidence of a mission-oriented training emphasis at any command level.

## GENERAL SUPPORT MAINTENANCE

### Structure of GS Units

The Army has four different types of military-staffed GS units which primarily support tactical and combat vehicles. Two are unique to CONUS: the HEM company and the TASCOM company.<sup>2</sup>

The two types of GS units in USAREUR--area maintenance company and the CRE company--are derivatives of the TASCOM and HEM TOEs. The area GS company is primarily the TASCOM unit with an armament repair platoon added, and the DS maintenance platoon and the small component repair section deleted. The CRE company evolved from a collection and classification company through the addition of a service section and the component repair platoon from the HEM company.

On the surface, the differences between the CONUS and USAREUR GS units appear relatively small. In actuality, however, they are significant. Not only do the units differ in structure, but also in assigned missions. Little compatibility exists between CONUS and USAREUR GS units.

### Mission Assignments

The peacetime mission assignments of GS units vary considerably: from only DS, to predominantly DS, to predominantly GS, to only GS. Of the 14 GS units visited, several are assigned only DS level tasks. The others concentrate their resources on the GS repair of just a few components/assemblies/end items.

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<sup>2</sup>The TASCOM company has a mixed DS/GS mission, with approximately 35 percent of unit capability being GS.



Table III-4 provides a display of GS unit support to various combat and tactical vehicle assemblies. The entries indicate the number of GS units that have repaired at least one of the associated assemblies. The reporting time frames varied from five to nine production months. Three observations emerge from this table (and supporting data in the appropriate working paper):

- Few GS units have combat vehicle major assembly repair missions (no unit in USAREUR).
- The assigned assembly repair missions tend to be the less complex assemblies, mostly from tactical vehicles.
- GS units do not have assembly repair missions consistent with their TOEs (all assemblies listed in Table III-4 are within the mission responsibilities of the units).

Very much the same situation was observed for GS unit support of end items. Few units are assigned significant end item missions; only three (one in USAREUR, two in CONUS) are routinely maintaining combat vehicles.

It frequently has been stated that CONUS GS units are hindered in developing a more comprehensive GS mission because the desired workload must be negotiated from post maintenance. The implication is that post maintenance is very protective of its workload. While this is partly true, it is also true that few post/unit commanders have recognized the need for enhancing GS level missions and fewer still have taken any positive actions to do so. Post commanders have found it very convenient to assign the predominant GS role to the TDA mechanics. These are full-time, highly-experienced mechanics who can ensure high equipment readiness rates. It must be noted, however, that post commanders are not evaluated on the readiness condition of TOE GS unit mechanics.

USAREUR policy on GS unit missions is to assign only the simpler components, assemblies, and end items to TOE GS units, leaving the more complex repairs for the foreign-national-staffed SRAs/depot. The driving factor



TABLE III-4. NUMBER OF GS UNITS SUPPORTING MAJOR ASSEMBLIES

End Item/Assembly	CONUS		USAREUR		Total(14) <sup>a</sup>
	TASCOM(2) <sup>a</sup>	HEM(4) <sup>a</sup>	Area(4) <sup>a</sup>	CRE(4) <sup>a</sup>	
<u>M151A1:</u> Engine	1	2	0	0	3
Transmission	1	3	1	1	6
Differential	1	3	1	1	6
<u>M35A2:</u> Engine	1	2	0	0	3
Transmission	0	1	0	1	2
Transfer	0	0	1	1	2
Steering Gear	0	0	0	1	1
<u>M54A2:</u> Engine	1	2	0	0	3
Transmission	0	1	0	0	1
Transfer	0	0	1	1	2
Steering Gear	0	0	1	1	2
<u>M123A1C:</u> Engine	0	0	0	0	0
Transmission	0	0	0	0	0
<u>M561:</u> Engine	0	0	1	0	1
Transmission	0	0	0	0	0
Transfer	0	0	1	0	1
<u>M113A1:</u> Engine	0	2	0	0	2
Transmission	0	1	0	0	1
Transfer	0	1	0	0	1
Final Drive	0	2	0	0	2
<u>M60A1:</u> Engine	0	2	0	0	2
Transmission	0	2	0	0	2
Final Drive	0	3	0	0	3
<u>M109:</u> Engine	0	0	0	0	0
Transmission	0	0	0	0	0
Final Drive	0	0	0	0	0
<u>M110:</u> Engine	0	0	0	0	0
Final Drive	0	0	0	0	0
<u>M578:</u> Engine	0	0	- <sup>b</sup>	- <sup>b</sup>	0
Transmission	0	0	- <sup>b</sup>	- <sup>b</sup>	0
Final Drive	0	0	- <sup>b</sup>	- <sup>b</sup>	0
<u>M88:</u> Engine	0	0	0	0	0
Transmission	0	1	0	0	1
Final Drive	0	1	0	0	1
<u>M551:</u> Engine	0	1	0	0	1
Transmission	0	1	0	0	1
<u>M548:</u> Transfer	0	0	0	0	0

<sup>a</sup>Number of units being reported upon.

<sup>b</sup>No known reason for data not being available.

for this policy appears to be funding. If the repairs are performed by TOE units, then COSCOM/SUPCOM funds must support that repair; however, if centrally repaired (especially at Mainz Army Depot), then other organizations fund the repair.

#### Unit Capability

Our definition of GS unit capability was:

During peacetime, GS units should be routinely supporting the components, assemblies and end items they will maintain during wartime; where mission differences exist, the units should have comprehensive training programs to compensate for the disparity.

Overall, GS units are unprepared for wartime.

At the component and major assembly level, only a few units have significant peacetime workloads, but even that workload is restricted to a few assemblies. Not one unit has a component/assembly repair program that spans more than a few different combat and tactical vehicles. Nor has any unit established a training program which goes beyond normal production items. Similar results were observed for end items. Only a few GS units are receiving any exposure to end items; offsetting training programs do not exist. As in DS units, the MOS manuals are not being used.

It would take on the order of months of intensive maintenance training for GS units to perform to the level of capability called for in their respective TOEs. The degree of training required varies with the unit, but no unit surveyed had a readiness even close to its TOE capability.

This general condition of GS level maintenance appears to stem from one underlying factor: indecision as to the exact role for TOE GS units in the Army maintenance structure. Three different roles are frequently attached to GS units:

- backup DS

- operating in a fix forward environment
- working out of fixed facilities in support of the supply system

GS units are not receiving the necessary training to function effectively in any of these roles. They are not receiving the diagnostic and end item work to successfully execute either the backup DS or fix forward roles. Nor are they receiving the required component/assembly overhaul experience to provide adequate supply system support.

The absence of a specific GS mission has a significant impact at the unit level. Namely, there is no incentive to restrict the workload evacuations to civilian activities, whether these be post maintenance shops in CONUS or SRAs/depot in USAREUR. When TOE units are assigned specific GS missions, even though limited in scope, they have shown the potential to perform the necessary repairs. But, if units are provided easy evacuation channels and there are few pressures to accomplish the repairs with military mechanics, then the workload will naturally flow to the civilian backup activities. Unit capability then deteriorates. This is the present condition of GS units in both CONUS and USAREUR.

#### RESERVE COMPONENTS

##### Importance of Reserve Components

The "Total Force" concept is commonly referred to in discussions of Army maintenance strength and capability. The term expresses the view that Active and Reserve Components working together form a single Army, each highly dependent on the other. This is particularly true in the area of maintenance, especially nondivisional units. The Reserve Components have been assigned a significant percentage of these companies:<sup>3</sup>

- 80 percent of the Forward Support, DS

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<sup>3</sup>Expressed as a percentage of units in the Reserve Components, FORSCOM, and USAREUR.

- 33 percent of the Rear Support, DS
- 72 percent of the TASCOC, DS
- 80 percent of the HEM, GS
- 94 percent of the LEM, GS

The heavy dependence on RC maintenance units is even more significant when it is recognized that the total number of maintenance units falls short of the Army's requirements. The status of RC maintenance units is, therefore, critical to the overall effectiveness of the "Total Force."

#### Training Opportunities

Maintenance Time. Personnel in RC units are required to attend 48 Inactive Duty Training (IDT) drills per year. These 4-hour drills, usually held on weekends, total 192 hours annually. Not all of this time is available for maintenance training, however. The diversions include weapons qualification, field training exercises, and preparation for inspections. Records of the amount of IDT devoted to maintenance training are not kept. Nevertheless, unit personnel indicated an average of seven IDT drill weekends per year (112 hours) available for maintenance training.

In addition, the Annual Training (AT) program provides another 88 hours, of which 64 hours are typically devoted to maintenance training. Together, AT and IDT probably provide a maximum of 176 hours of maintenance training annually, the equivalent of one work-month (22 days).

Organizational Influence. Within each state, the ARNG is a self-sufficient organization, independent of outside organizations for maintenance support. DS/GS maintenance of ARNG equipment is provided by state maintenance shops. Each of these shops is usually located in close proximity to at least one ARNG TOE maintenance unit, thereby enhancing the opportunity for some TOE units to receive training workload. (This potential workload can



be especially relevant because most of the RC combat forces and equipment are assigned to the ARNG.) USAR maintenance units, with multistructured commands, little combat equipment, and no organic civilian DS/GS capability, rarely have similar opportunities during IDT.

Nature of Training. The specific type of maintenance training workload made available to RC units is often sporadic, of limited duration, and aimed at only a few MOSs. No unit is consistently receiving a full range of hands-on training opportunities. Divisional maintenance battalions appear to receive the best training workloads. Nondivisional DS and GS units rarely receive training on combat vehicles during IDT and only occasionally during AT. Except for a very few units, USAR maintenance companies never see a combat vehicle. Component rebuild work for GS units is infrequent; power train components for tactical vehicles are available to only a few units but similar components from combat vehicles are never available. IDT training workload on some equipment appears almost impossible to obtain in some commands, yet is no apparent problem in others. Training opportunities also vary significantly for similar units within the same command. Most IDT workloads are obtained through personal contacts. We did not observe any mechanism by which RC maintenance units are assured of hands-on training workload for all sections on a regular and continuing basis.

One problem in obtaining maintenance training workload during IDT is the availability of sufficient uninterrupted time to complete the diagnosis and repair. There are two dimensions to the problem: the training itself is deficient if the same repair team does not fully complete a job, and there is a greater likelihood of faulty maintenance if more than one team is used. Rather than risk faulty maintenance, suppliers of equipment needing repair may seek other sources for that repair. But, if the same repair team performed

the maintenance over several weekends, the memory lost from the fragmented time applied to the job makes this approach little better than employing different teams.<sup>4</sup>

#### Personnel Conditions

Fill and Turnover Rates. Most RC maintenance units have difficulty recruiting and retaining personnel. The ARNG and USAR units visited had average personnel fill rates of 78 percent and 68 percent of MTOE, respectively. According to unit readiness criteria, units with 78 percent fill rates would be "capable with major limitations," while units with 68 percent fill rates would be "incapable."

The average annual turnover rate for ARNG units is 23 percent, equivalent to the acquisition of a totally new force every 4 years. In the USAR, the average annual turnover rate is much higher: 40 percent, or a new force every 2½ years. Within both components, however, the positions most susceptible to turnover are the lower grades. But in a maintenance unit, these are the direct laborers (the E-4s and below, skill level 10s) and they constitute the maintenance capability of the unit.

MOS-Qualified. Personnel are classified as MOS-qualified if, in the judgment of the unit commander, they are capable of performing their MOS-related duties. The criteria used for determining MOS-qualification reflect a variety of considerations. For example, if an individual is a graduate of an AIT school, or has received six months of OJT in the MOS during IDT, or has worked in the MOS during AT, then that individual may be considered MOS qualified. Yet, according to TRADOC and field personnel, Active

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<sup>4</sup>Careful planning can overcome this problem, however. For example, diagnosis and repair times could be ascertained for components and end items and adjusted to account for mechanic inexperience. These repair times can then be used as a basis for matching repair tasks with available training time, e.g., simple component repair or replacement could be weekend tasks and complex component rebuild performed during AT.

Army AIT graduates require a minimum of 3 full-time months of OJT to become minimally proficient (after their MOS course). Yet, 60 percent of RC non-divisional units are reporting training readiness conditions which indicate they require only 2 to 4 weeks of post-mobilization training to become fully capable.

RC maintenance units report MOS-qualified personnel in the range of 60 to 70 percent of full MTOE. As a percentage of actual strength, USAR units show 89 percent are MOS-qualified. For ARNG units, it is 84 percent in non-divisional companies and 86 percent in divisional battalions. In view of the limited time available for maintenance training, the deficiencies in hands-on training, and the high personnel turnover rates, the MOS-qualified rates appear to overstate actual unit capability.

Dual-Status Personnel. There are nearly 30 dual-status technicians in the typical ARNG maintenance unit (19 percent of actual strength). USAR units average fewer than 3 technicians (or approximately 2 percent). All full-time personnel working for the ARNG must also belong to an ARNG component in a capacity similar to their civilian position. For mechanics working in the various state maintenance shops, the most likely ARNG unit is a nearby TOE maintenance unit.

USAR full-time personnel in AMSAs must belong to a TOE unit, but not necessarily in capacities similar to their civilian positions. Furthermore, DS and GS maintenance on USAR equipment is provided by FORSCOM and TRADOC post maintenance activities. Civilian mechanics employed at these activities do not have reserve affiliation obligations.

#### Unit Capability

Overall, we observed few indicators that USAR and ARNG maintenance units are capable of fulfilling their TOE mission. The limited training time restricts the development of comprehensive mission-oriented training programs.



Two factors suggest that ARNG units have the potential to be more capable than USAR units: (1) the expanded use of dual-status technicians within the ARNG, and (2) the conduciveness of the ARNG maintenance organization to providing opportunities for hands-on training.

Dual-status technicians most often are not assigned to direct labor positions. Rather, they are section/platoon leaders or work in the shop office. This is an undoubtedly an asset to unit management and training. The problem is that in the short-term, these technicians can mask overall unit deficiencies by performing the required technical tasks themselves. Over the long term, maintenance strength and high production levels must come from those assigned to perform the direct labor. But, under current conditions, IDT and AT provide insufficient training opportunities to develop maintenance skills in the lower grades. This situation appears to be more pronounced in the USAR than in the ARNG. The ARNG has a maintenance organization that more closely aligns equipment maintenance and maintenance training of TOE units. Thus, there are added opportunities for OJT on a wider range of equipment.

There are many indicators that RC maintenance units cannot be relied upon in the short term. Without intensive maintenance training, they will not be able to provide the support required by the combat forces. Even though readiness ratings are already low, they do not accurately portray the extent of unit weaknesses. Personnel shortages are usually cited as the principal cause of units not being fully capable; study findings suggest the problems go beyond that limitation.



#### IV. EMERGING DIRECTION OF ARMY MAINTENANCE

##### HISTORICAL PERSPECTIVE<sup>1</sup>

Army logistics units deployed to Vietnam in 1965 and early 1966 were organized under the Technical Services configuration. In late 1966, these units were reorganized in conformity with the Combat Support To Army concept. As a result, there was considerable turmoil in the Army logistics structure; units were deactivated, new units activated, functions realigned, and personnel transferred. This turmoil, along with an increased number of combat units being assigned to Vietnam, resulted in the surfacing of many maintenance problems. Foremost among these were:

- heavy overloading of DS maintenance units; GS units were then used in DS roles
- inadequate maintenance capacity; contractor support was required, initially at the GS level, but eventually extended to all levels of vehicle maintenance
- inexperienced mechanics; recent graduates from MOS schools required several months of OJT (with close supervision) before they could be considered productive

Of the "lessons learned" during the Vietnam experience, two were stressed by the Joint Logistics Review Board:

- The Army force structure had been organized on the assumption, that, in a contingency the magnitude of Vietnam, the reserve components would be mobilized; the decision not to call up the reserve components had a serious impact on the force structure.... The possibility that reserve components in future contingencies might not be mobilized should be considered in future plans.
- Maintenance personnel arriving in Vietnam for assignment to direct and general support maintenance units were, for the

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<sup>1</sup>Material in this section was derived from Logistic Support in the Vietnam Era: "Monograph 13 - Maintenance," prepared by the Joint Logistics Review Board, December 15, 1970.

most part, incapable of performing intermediate level maintenance tasks without close supervision. Between 30 and 120 days of on-the-job training were required, depending on equipment complexity, before the individual was considered minimally proficient.... Maintenance personnel should be assigned to CONUS based intermediate level maintenance activities for a period of time prior to overseas assignment and a broadening of the CONUS rotational base is necessary so that an individual can be assured of continued utilization and development of his skill subsequent to an overseas tour.

As a result of Army dependence upon contractor maintenance, the Joint Logistics Review Board also recommended that the Army determine its need for contractor support (i.e., nonorganic capability) and then develop specific plans for effective use of that support. This major recommendation was aimed at improving Army plans for the use of nonorganic maintenance capability.

#### RECENT MAINTENANCE INITIATIVES

The Army is currently developing three major programs which could influence its maintenance structure significantly: Restructured General Support, Logistics Operations in the Communications Zone, and the Support Unit Improvement Program.

##### Restructured General Support

Under existing doctrine, GS level maintenance is organized on a functional basis. However, the Israeli experience in the Mid-East War of 1973, particularly the forward area repair of major weapon systems, was one of the primary factors which caused the Army to question the viability of the functional alignment. In 1975, the Army decided to evaluate the establishment of a commodity-oriented GS base in the corps. Restructured General Support (RGS) eventually evolved from that evaluation.

The principal features of RGS are:<sup>2</sup>

- The company will continue as the basic building block.

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<sup>2</sup>U.S. Army Logistics Center, Restructured General Support, Draft Final Report, August 1978.

- Each maintenance company will support just a few commodities such as equipment families for ground support, communications, electronics, tanks, light armor vehicles, artillery, or wheeled vehicles.
- End items and components will be repaired and returned to users, except for components and assemblies in support of the corps DX program.
- Corps GS efforts will be support-forward oriented, including technical inspection, battle damage assessment, collection/cannibalization, and repair.

RGS has been subjected to extensive evaluation, including three simulation-based modeling efforts and a field test at Fort Hood. The Fort Hood test focused on the operations of a GS unit in an RGS role and its ability to fully support selected combat vehicle end items and components. The most relevant findings were that: (1) the maintenance concepts of RGS were fundamentally sound; (2) military mechanics could repair complex end items and components at the GS level; and (3) no unique training requirements were identified.

The field test results imply that any GS maintenance company can be readily transformed into an RGS unit. Such a conclusion is not warranted however. The Fort Hood unit was accorded many special considerations, including:

- Prior to the test, all unit mechanics received an intensive, six-week training program under the close supervision of post maintenance mechanics.
- Unit personnel routinely received exemptions from special duties, thereby increasing time-in-shop.
- Supervisors and mechanics were initially precluded from transfers, thereby lessening the impact of personnel turnover.

These considerations were required to overcome long-standing problems routinely confronted by Army maintenance units.

The special training was required to compensate for deficiencies in classroom and OJT programs. For Army mechanics, formal instruction represents



just an introduction; it must be supplemented with extensive hands-on training under the watchful eye of skilled supervisors. Such OJT is almost non-existent in the Army today.

The exemptions from special duties and retention of personnel in existing positions ensured that the unit had a stable workforce routinely available for maintenance duties. This situation is atypical for Army maintenance units--mechanics are generally available for maintenance duties only 4 hours each working day, and annual turnover rates exceeding 50 percent are common.

#### Logistic Operations in the Communications Zone

In August 1977, a study of USAREUR combat service support in the corps and COMMZ was completed.<sup>3</sup> Twenty-two major concepts for logistics support of USAREUR were recommended and subsequently approved. Several focused on maintenance:

- Corps GS maintenance will be oriented to support-forward and return of weapon systems to combat forces.
- GS maintenance in support of the supply system will be performed outside the corps.
- COMMZ GS maintenance will be oriented to corps backup and support of units passing through the COMMZ.
- DARCOM (i.e., the U.S. Army Development and Readiness Command) will have consistent peacetime and wartime missions.
- DARCOM will perform the GS maintenance in support of the theater supply system.

The concepts relevant to this study are that GS support of the supply system will be performed by DARCOM, outside the corps, during both peacetime and wartime. These recommendations have essentially been implemented. If we consider the three SRAs to be DARCOM-like activities, their

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<sup>3</sup>Deputy Chief of Staff for Logistics, Phase II Study - Logistic Operations in the Communications Zone, Department of the Army, August 1977.



production, combined with that of the DARCOM depot at Mainz, accounts for over 75 percent of all maintenance performed within USAREUR in support of the supply system. (The SRAs and Mainz are considered to be in the COMMZ.) Much of the balance of the supply support is being accomplished by corps TOE units, but these units are concentrating on the easy-to-repair components and assemblies. Given this type of peacetime support, there is little likelihood that any TOE units could effectively assume an expanded GS role during wartime. Thus, there will be continued reliance upon DARCOM.

The gravitation of GS level workload to Mainz and the SRAs did not result from demonstrated inability on the part of TOE units nor from the need for significant changes in doctrine. Rather, two external factors were responsible. One, the repairs performed at Mainz and the SRAs are free to the corps; thus, there is a strong disincentive for TOE units to perform the repairs. Two, USAREUR maintenance officers are inconsistent on the peacetime/wartime missions for GS units; thus, the units are not supporting either the traditional GS role (i.e., working out of fixed facilities, supporting the supply system, etc.) or even that anticipated under RGS/COMMZ (i.e., support-forward, repair and return to user, etc.).

#### Support Unit Improvement Program

The basic concept of the Support Unit Improvement Program (SUIP) is to assign wartime missions to RC units according to a priority allocation scheme. Currently, all COSCOMs are well below authorized strength and require augmentation during a national emergency. The initial objectives of SUIP are to identify RC combat service support units to fill specific roles in the COSCOMs required in the European theater. Until recently, these roles have changed frequently to keep pace with USAREUR changes in employment plans. Now, USAREUR requirements have been stabilized for planning purposes and

specific assignments can be made without regard to the turbulence previously experienced. These assignments will then allow RC units to improve military readiness by concentrating their training programs on the identified missions.

The initial benefits from SUIP will be the improvement in matching priority assignments with ready units. The long-term benefits to RC units, however, are questionable. No significant improvements in unit capability will ever result simply from aligning RC maintenance units with specific support missions. The key to that capability is in the hands-on training that RC mechanics receive during both IDT and AT. While SUIP may be an initial step in this direction, other actions are also required.

#### MAINTENANCE IN THE 1980s

Although new and more complex equipments are constantly entering the inventory, repair procedures remain fundamentally the same. Changes in doctrine may cause shifts of specific tasks between levels, a reorganization of various maintenance units, or even the assignment of new missions to existing units, but, for the most part, they have little impact on the maintenance capability of the Army mechanic. That capability, however, is at the heart of the Army maintenance structure.

#### Mechanic Readiness

Few changes in mechanic readiness have occurred since Vietnam. The problems that plagued Army maintenance in the late 1960s are still present, possibly even intensified by greater dependency upon younger, lesser-skilled mechanics. These problems are being masked by such practices as excessive component replacement (i.e., living off the supply system), heavy reliance upon backup units (which seems unnecessary during peacetime), assignment of key maintenance roles to civilian and foreign-national-staffed units, and concentration on easily measured equipment readiness rates.

Deficiencies in mechanic readiness are not being recognized at the proper level. Even the developers of new doctrine are failing to give the problem appropriate consideration. The evaluators of the RGS field test, for example, did not give an accurate representation of the training requirements necessary for a unit to function effectively at the GS level. They noted that "no special training" was required; yet test unit mechanics received extensive special training.

#### Dependence Upon Nonorganic Units

During Vietnam, the Army found it had inadequate capacity in active units. This, coupled with the decision not to activate the Reserve Components, resulted in contractor support being required at all levels of maintenance. The present heavy reliance upon Reserve Components for combat service support already severely limits the Army's responsiveness. The placement of much of USAREUR's GS workload with foreign-national-staffed units and the dominance of post maintenance shops on CONUS installations further degrades organic maintenance capability.

Current planning provides no basis for expecting any improvement in this situation during the 1980s. Acceptance of the COMMZ study recommendations further entrenches USAREUR's dependence upon civilian support. Significant changes at CONUS installations are not being considered. In the event of a Vietnam-type war in the 1980s, the Army would again have to rely heavily upon contractor support for both capacity (most of the combat service support units are in the Reserve Components) and capability (the key maintenance skills have already been transferred to nonorganic units).

#### Status of Reserve Components

Our review of the capability of RC units provides considerable insight into unit status during the 1980s. We found most USAR and ARNG maintenance units incapable of satisfying their TOE missions without extensive

maintenance training. The capability of these units is not likely to improve during the early 1980s. The SUIP program is a positive step toward enhancing unit capability. However, when the obstacles confronting these units (such as personnel fill and turnover rates, absence of equipment for training purposes, and limited maintenance training time) are assessed, the real impact of SUIP and other programs will be minimal.

Few real changes in Army maintenance can be anticipated during the 1980s. New doctrine, especially at the GS level, will be introduced, but it will be only an official recognition of some practices that have evolved over time. Unit capability will remain unchanged. The pressures for production, at the expense of training, will still be present; mechanic readiness will continue to suffer.



## V. RECOMMENDATIONS TO IMPROVE UNIT CAPABILITY

### INTRODUCTION

The message of the preceding chapter is clear: during the 1980's, the Army will implement several changes in its maintenance support of combat and tactical vehicles. These changes, however, will have little impact on unit capability because they are not directed at enhancing the foundation of that capability--mechanic readiness.

In this chapter, we provide several recommendations aimed at correcting the major deficiencies inherent in the direction Army maintenance is moving. Some of the recommendations are minor and can be readily implemented. Others are far-reaching and require extensive definition, development, and coordination before they can be adopted. All appear to be urgently needed.

### DIRECT SUPPORT MAINTENANCE

As noted in Chapter III, DS units were judged capable, but with several reservations. The following recommendations, if adopted, will correct most of the observed shortcomings.

#### Reliance Upon Post Maintenance

The dependence of TOE units on post maintenance activities for backup DS is extensive. In some cases, the DS workload evacuated to post maintenance is said to exceed the capacity of TOE units; in others, the character of the work is reported to be beyond their capability. However, TOE units are configured for wartime and should have both the capacity to maintain the equipment of supported units during peacetime and the required technical capability. The assignment of a backup DS role to post maintenance eases the pressure on TOE units to fully develop both unit capacity and capability.

Recommendation: FORSCOM and TRADOC Headquarters initiate changes to all Installation Support Plans so that post maintenance activities no longer provide backup DS to any TOE maintenance unit.

Implied in this recommendation are: (1) the reassignment of DX item repair missions from post maintenance activities to DS units (all DX items repairable at the DS level should be supported by TOE units), and (2) the reassignment of "the repairs that have always been performed by post maintenance" to DS units. When TOE units encounter support problems, post maintenance mechanics should serve primarily in an advisory role.

While the impact of implementing this recommendation may initially result in lower equipment readiness rates, that by itself will be beneficial because it will permit a more accurate definition of DS unit training shortfall. The long-term benefit, however, will be increased unit capability; the division commander will not permit equipment readiness rates to remain low.

#### Nondivisional Unit Missions

Many nondivisional DS units in CONUS have been assigned maintenance missions inconsistent with their TOEs. Consequently, numerous mechanics within these units (turret, track, fire control, and artillery mechanics especially) do not have opportunities to exercise and develop their repair skills.

Recommendation: FORSCOM Headquarters evaluate the peacetime mission assignments of all CONUS nondivisional DS units; where those assignments are inconsistent with TOE missions, develop and implement alternatives for insuring routine workload for all MOSSs in those units.

When the evaluation is completed, almost every nondivisional unit in CONUS will be identified as deficient in some type workload. At most installations, the deficiencies may be corrected simply by realigning support assignments or establishing workload programs for the units. At other installations (such as those with a nonmechanized infantry division or a TRADOC

training center), the desired workload may not be possible. The nondivisional units assigned to these installations may need to be transferred to installations where the workload is available.

#### Funding Practices

The preceding recommendations can significantly alter the maintenance support practices on CONUS installations. However, there is no mechanism built into these mission realignments to provide the needed management discipline. One action, essential to providing the necessary discipline, has already been implemented by at least one installation, and that is source-funded work.

Recommendation: All DS level work performed by post maintenance activities in a backup DS role should be funded (both labor and parts) by the supported maintenance unit.

The implementation of this recommendation will not require major adjustments to post maintenance accounting systems. Those systems presently identify all job orders by customer, including work in support of DS and GS units. The DS level work that should have been performed by TOE units will require special identification, but that can be accomplished during initial inspection.

This recommendation does suggest the establishment of uniform repair cost manuals. Those manuals, by identifying specific repair costs, may be advantageous to both TOE units and post maintenance activities.

#### GENERAL SUPPORT MAINTENANCE

##### Mechanic and Unit Readiness

As noted in Chapter III, most GS maintenance units are not capable of supporting their TOE missions. The assigned workload is not consistent with either the prevailing GS doctrine or the GS doctrine emerging under RGS/COMMZ. Offsetting training programs have not been established.

The current condition of GS maintenance appears similar to that observed by the Joint Logistic Review Board--units are incapable, and mechanics require extensive OJT to develop the necessary skills. The Board offered a judgment that from one to four months of intensive OJT was required before a mechanic was minimally proficient. Current evidence from the field and TRADOC's structure of MOS training reinforce this estimate.

Recommendation: Department of the Army establish a Mechanic Enhancement Program for GS-level mechanics; that program should integrate apprentice training, initial field unit assignments, and advanced technician training.

The three segments of the Mechanic Enhancement Program are individually discussed below.

Apprentice Training. All AIT graduates scheduled for assignment to GS maintenance units would first serve in an apprentice capacity in a CONUS post maintenance activity. The scheduled apprenticeship period would be approximately four months, varying by MOS. During this period, the apprentices would be rotated through various aspects of their respective MOSs, under the close supervision of experienced civilian mechanics. Both end item and component repair skills would be emphasized.

All apprentices would report to the senior officer in the post maintenance activity, and would not be assigned any nonmaintenance duties. The senior officer would be specifically assigned the mission of training these apprentices.

The total size of the apprentice program can be based on the direct labor mechanic positions, E-3 and below, in Active Army GS units. These include:

- the five HEM GS units in CONUS
- the two TASCOC units in CONUS (GS portion only)



- the five Area GS units in USAREUR
- the five CRE GS units in USAREUR

There are approximately 815 E-3, skill level 10, direct labor positions in these 17 units.

The apprentice program requirements are based on the following assumptions: (1) the average initial enlistment is 3.36 years,<sup>1</sup> (2) basic training requires 7 weeks, (3) the average length of AIT is 12 weeks, and (4) the apprentice training will average 16 weeks. These assumptions allow for a balance of 140 weeks, or 2.69 years, in a CONUS or USAREUR GS unit. If 815 positions are to be filled during this period, then 303 apprentices must be processed annually.

Six posts appear to have the balanced vehicle workload necessary for a successful apprentice program: Fort Carson, Fort Hood, Fort Knox, Fort Polk, Fort Riley, and Fort Sill. Assuming that 3 apprentice programs can be effected annually, then each post will average 17 apprentice mechanics per program.

To ensure continued apprentice progress, TRADOC should develop and administer periodic progress reviews. The apprentices not progressing as expected should be removed from the program.

Initial Field Assignment. Upon completion of the apprentice portion of the Mechanic Enhancement Program, the mechanic would be assigned to a direct labor position in a GS unit, either in CONUS or USAREUR. This phase of mechanic training is crucial to the full development of a GS maintenance capability in the Army. The current practices of GS units being assigned the

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<sup>1</sup> Job Satisfaction Survey of 5,000 First Term Soldiers, U.S. Army Military Personnel Center, November 1977.

less complex components and few combat vehicle end items must cease for this training step to be successful.

Recommendation: FORSCOM and TRADOC Headquarters task Installation Maintenance Officers to develop a workload plan that will ensure a continuing, varied, and comprehensive component and end-item workload for assigned GS units.

Recommendation: USAREUR MMC, with the assistance of the COSCOMs/SUPCOM, reassign TARP component and end item workload to TOE GS units and establish combat vehicle component and end-item production programs for each GS unit.

A primary factor contributing to the unbalanced workload is in USAREUR GS units is the availability of "free" components and end items from alternative repair activities. This funding practice has resulted in a degrading of TOE unit capability.

Recommendation: USAREUR MMC modify theater funding practices so that the availability of free components and end items does not result in practices which preclude GS units from fully developing assigned maintenance skills.

Unless the Army takes action along the recommended lines, the real benefits of the apprentice program will never be realized.

Advanced Technician Training. Upon completing their initial term of duty, mechanics may: (1) leave the Army; (2) reenlist, but change career fields; or (3) reenlist and stay in the same career field.

Approximately 29 percent of personnel in the maintenance career fields reenlist for a second term.<sup>2</sup> It is not known how many mechanics change career fields or first enter the maintenance career field during their second term. But for purposes of the recommendation, it is assumed that the number leaving equals the number entering. Applying the 29 percent reenlistment rate

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<sup>2</sup>Based on fiscal 1978 data, four maintenance fields experienced an average first term reenlistment rate of 28.9 percent (the Army-wide reenlistment rate was 35.6 percent).

to the 815 direct labor mechanics in GS units yields 236 GS mechanics available for additional maintenance training at the beginning of their second term of duty. Since the initial enlistment is 3.36 years, approximately 70 of these experienced, direct labor mechanics can be expected annually.

These mechanics would be assigned to CONUS post maintenance activities for advanced technical training. This assignment would be for a period of four months, with emphasis on inspection, diagnosis, and other advanced maintenance skills. Although the technicians would be assigned to the same post maintenance activities as the apprentices, they should have no supervisory responsibilities.

Assuming that three advanced technician programs can be accomplished annually at each of the six posts, then four technicians per program should be assigned to each post. This will yield 72 highly trained maintenance technicians annually for assignment to key maintenance positions.

Establishment of a Mechanic Enhancement Program is a major undertaking.<sup>3</sup> Few benefits will be realized in the short-term, but the potential long-term benefits are significant. The apprentice training will reinforce AIT; all graduates will be more capable of significant contributions to unit mission upon arrival. The improved mission assignments will ensure that varied and challenging workloads are available--mechanic morale will thus improve. The new mission assignments in CONUS will also provide a sound rotation base for GS mechanics. The advanced technician training will provide career mechanics with an opportunity to fully develop and refine their skills. This added knowledge can then be used to better guide lesser skilled mechanics. While any one of these segments will result in some improvement to

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<sup>3</sup>It may also require various modifications to the Army personnel system. The specific modifications, however, have not been determined.



GS maintenance, the maximum benefit will result only from the complete integration of each segment--apprentice training, mission-oriented field assignments, and technician training--into a complete Mechanic Enhancement Program.

The success of the Mechanic Enhancement Program depends on the cooperation of the civilian mechanics at the six post maintenance activities. Some pertinent considerations are:

- Some civilian personnel may resent the intrusion of military personnel.
- Many civilians may fear for their jobs. TDA activities are subject to frequent manpower cuts, and any hint of free production from military personnel may be perceived as an excuse for reducing the civilian labor force.
- Production may suffer, particularly in the initial phases of the program, as the civilian mechanics are given training duties in addition to production responsibilities.

The need for full cooperation from the civilian workforce cannot be overstated. However, the assignment of a training mission to post civilians is not a new concept. Programs of this type have successfully been employed at several posts, including Fort Hood, Fort Knox, and Fort Polk. Most of those programs had narrow objectives: the overhaul of a particular engine, for example. The emphasis in the Mechanic Enhancement Program would be much broader, covering a range of end items and assemblies.

#### BENEFITS TO THE ACTIVE ARMY

The preceding recommendations are directed toward improving unit capability through enhanced mechanic readiness. Many additional benefits will accompany such improvement, including:

- Improved unit capability will increase the responsiveness of TOE maintenance units and provide added flexibility in the Army maintenance structure.
- The added pressure for TOE units to perform more repairs will increase time-in-the-shop (mechanic availability) and direct labor charges (mechanic utilization).



- Unit morale will increase because of the added maintenance opportunities; under existing practices, mechanics are easily discouraged because of the workload evacuations and the amount of time devoted to nonmaintenance duties.

#### READINESS OF RESERVE COMPONENTS

The problems facing the RC are nearly overwhelming. Each unit operates in a unique environment, and few general conclusions can be drawn. One conclusion can be made, however: the Department of the Army is unaware of the true condition of RC maintenance units. Our primary recommendation is aimed at correcting this situation. An additional recommendation is offered that builds upon the anticipated results of the primary recommendation.

According to most indicators, the readiness of RC maintenance units is extremely low. Not only do these units face recruiting and retention problems, but they are also unable to attract skilled personnel. When other factors are considered, such as the number of hours available for maintenance training during IDT and AT, high turnover rates, and limited workload opportunities, unit readiness is even lower than reported.

#### Establishing a Baseline

It is frequently assumed that if the authorized personnel are on board, then RC maintenance units can perform to the level called for in the TOE. This assumption is not valid. While fill rates are an obvious problem, these units face a far more critical challenge: developing and sustaining highly technical skills in an environment which is seriously deficient in training opportunities. Existing unit readiness indicators do not accurately portray progress toward meeting this challenge. Given its heavy dependence upon the RC maintenance units, the Army must have an accurate evaluation of their support strength.

Recommendation: Department of the Army conduct an independent and comprehensive appraisal of the maintenance readiness

of every divisional and nondivisional DS and GS unit in the USAR and ARNG.

The objectives of the appraisal should be to:

- assess unit capability, at the individual section level, to perform its TOE mission
- determine unit weaknesses and strengths
- identify problems and circumstances unique to the unit, such as proximity to maintenance workload opportunities
- evaluate the effect of USAR and ARNG policies, practices, and organization on maintenance readiness

The appraisal should provide an accurate and complete definition of RC maintenance capability, which would be the basis for all actions concerning allocation of resources, establishment of priorities, assignment of training opportunities, etc.

At the conclusion of the appraisal, each unit should be classified as either capable, capable with major deficiencies, or incapable. The criterion should be the maintenance capability of individual sections in the unit.

#### Early Deploying Units

Little correlation was observed between the latest arrival dates (LADs) assigned RC maintenance units and their ability to satisfy mission requirements. Units with early LADs frequently appeared to be less capable than units with later LADs. A substantial revision of assigned LADs, based on maintenance readiness, is indicated. Only the most capable units should be assigned LADs of less than 60 days, for example; those units will not have any opportunity for added training upon mobilization, so they must be ready now.

The unit appraisal will identify those units which should receive the early LAD assignments. The high state of readiness assigned to these

units, however, is extremely variable, difficult to achieve, and equally difficult to sustain. The Army currently treats most RC maintenance units equally, regardless of assigned LAD, readiness, etc. This practice should be corrected to reflect the priorities implicit in the LADs.

Recommendation: Department of the Army develop and implement plans to ensure that early deploying Reserve Component maintenance units are capable of fully supporting their assigned missions.

Maintenance units with early LADs should not have to compete with late LAD units for sources of workload, prime training sites, or technical assistance. For early LAD units, continuing sources of workload should be developed, regulations modified to permit training opportunities not currently available, organization structures changed to encourage training assistance, full-time unit staffing increased for training management, and financial and promotional attractions offered to improve recruiting and retention. Without extensive support from higher commands, the readiness levels of these units will be unreliable. For early LAD units, an assured maintenance capability is required.

#### Late-Deploying Units

All units classified as capable with major deficiencies should be assigned LADs consistent with those judgments. These units may be strengthened through the development of programs aimed at increasing hands-on training. Several examples of such programs are:

- Re-orient AT to maintenance training. Few training benefits accrue to a unit assigned a specific support mission inconsistent with its TOE mission.
- Develop a cyclic pattern for AT to ensure a variety of training experiences. There are few benefits associated with units going to the same AT site and performing the same role year after year (except for divisional battalions in support of a division).

- Modify IDT schedules so that repair teams can be available on successive weekends to perform maintenance on equipment in the minimum calendar time.
- Modify property disposal procedures so that equipment can be diverted to maintenance units for training purposes.
- Develop a support structure for the USAR through the integration of post maintenance TDA activities and USAR maintenance units. Selected positions within the post maintenance shops could be converted to dual-status technician positions with assigned personnel being permitted to remain in these positions for a specified period.
- Develop programs to provide hands-on training opportunities specifically aimed at low-density MOSs. This requires centralized guidance and coordination, because there are generally too few personnel in any one unit for unit level training to be effective.
- Evaluate the feasibility of assigning maintenance units only to the ARNG where hands-on training opportunities currently are better than for USAR units.

Investments in the units classified as incapable should be held to a minimum. Those units require extensive maintenance training before they can be deployed. One way to obtain that training is by assigning the units, upon mobilization, to post maintenance activities. Resources needed for high-priority purposes should not be diverted to these units. They should be treated as essentially an untrained manpower pool.



## APPENDIX A

### MAINTENANCE MANPOWER REQUIREMENTS DETERMINATION

#### BACKGROUND

Working Paper No. 1, "Maintenance Manpower Requirements Determination," was completed in March 1978. This working paper addressed the development of maintenance unit TOEs and Manpower Authorization Criteria (MACRIT) and their relationship to personnel requirements; it also included an evaluation of Army methods for establishing TOEs and MACRIT.

#### THE TOE

Army doctrine for employment and sizing of maintenance support, as described in AR 750-1,<sup>1</sup> has evolved from doctrine established in the late 1960s. Although the Army has been continually developing, testing, and improving maintenance methods and concepts, the current doctrine in support of tactical and combat equipment has been relatively stable over the last decade.

The TOE is a document to configure units for combat. It also provides the basis for developing personnel and equipment requirements for combat service support units. The process of developing and maintaining TOEs is the same for all maintenance units. However, the degree of confidence in the TOE and its accuracy depends upon each unit's mission. Personnel and equipment requirements for a divisional maintenance battalion can be determined more readily than the requirements for a nondivisional maintenance unit, because the type and density of equipment that the battalion will support are known.

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<sup>1</sup>AR 750-1, "Maintenance of Supplies and Equipment, Army Materiel Concepts and Policies," 1 May 1972.

Nondivisional units, DS or GS, are structured on a building block basis, depending on the expected type/number of combat and combat support units assigned to the corps or COMMZ. Thus, the development of these units must be extremely flexible because of the manner in which they are assigned and augmented. Nevertheless, assumptions concerning type and number of units supported are developed so that equipment types and densities may be determined.

Once the specific support assignments have been established, the annual maintenance man-hours (AMMH) necessary to support that equipment are computed. The AMMH and the associated MOSs are obtained from the MACRIT, which establishes a relationship between the services a TOE unit is designed to perform and the number and type of personnel needed to provide that service. The total and type of support services required eventually determine the overall MOS requirements.

#### MANPOWER AUTHORIZATION CRITERIA

The AMMH portrayed in the MACRIT are composed of three elements: non-productive time (e.g., work details), indirect productive time (e.g., parts chasing), and direct productive time (commonly referred to as "wrench turning"). DARCOM is responsible for developing the direct productive time factors (the most complex of the three) required to maintain end items and components.

The various maintenance tasks necessary for proper operation of the equipment are initially identified by the equipment manufacturer. These tasks become a part of the Maintenance Allocation Chart (MAC), which is an integral part of the technical maintenance manual prepared for each type of equipment. The MAC indicates the lowest level of maintenance (i.e., OS, DS, GS, or depot)

at which each task should be performed. Some of the criteria used in selecting the level of maintenance are historical assignments for similar tasks and the anticipated repair times.

GRADE AND SKILL LEVEL DETERMINATION

The U.S. Army Military Personnel Center (MILPERCEN) is responsible for developing the Personnel Distribution Tables which prescribe grade and skill level ratios (i.e., E-3s, E-4s, E-5s; skill level 10, 20, 30) for each direct labor maintenance MOS. Resource limitations have recently resulted in the downgrading of many MOS position assignments.

The downgrading of positions has caused a dramatic reversal in the ratios between the lesser and more skilled positions, as illustrated for two TOEs in Table A-1. Previously, the skill level 10 entry position constituted only 18 and 24 percent of the direct labor positions in these two TOEs; under current TOEs, those positions account for 61 and 79 percent, respectively. As a result, MILPERCEN has had to increase the skill requirement of the lower grades; many advanced maintenance requirements, which once were attributed to skill level 20, are now assigned to skill level 10.

TABLE A-1. TOE SKILL LEVEL COMPARISONS

Type TOE	TOE Issue Dates	Percent Distribution by Skill Level			Direct Labor Positions in Unit
		10	20	30	
TOE 29-207H: Maint. Co., Forward DS	Original - 30 Jan. 1974	18	68	30	123
	Latest - 21 Sep. 1977	61	35	4	123
TOE 29-137H: Maint. Co., Heavy Equipment, GS	Original - 11 Dec. 1972	24	35	5	170
	Latest - 6 Dec. 1977	79	21	0	126

## PRIMARY OBSERVATIONS

### MACRIT Productive Time Factors

MACRIT factors must be applied under widely varying combat and environmental conditions that degrade their accuracy and application. While better than anything else currently available, they do have a number of weaknesses, such as a lack of consideration of cannibalization, average mechanic skills, equipment age, and the like.

Their most significant weakness inflexibility. Once a MACRIT direct productive time factor is established, it virtually becomes a monument. There is no attempt to compare these factors to actual field experiences. Even though peacetime field data may not be representative of combat conditions, the comparison of actual repair times and failure rates to engineered repair times and estimated failure rates could improve the MACRIT development process.

The Army is aware of these problems and has initiated a study of the MACRIT system for purposes of increasing its accuracy.

### Grade and Skill Level Determination

TRADOC and MILPERCEN appear to be working in opposing directions with regard to mechanic grades and skill levels. Increasing the dependence upon lower graded mechanics should have resulted in adding training requirements for TRADOC to assure that mechanic school graduates can accomplish the level of work ascribed to skill level 10. However, while MILPERCEN was increasing the skill requirements at the lower levels, TRADOC was downgrading the mechanic schools and sending less skilled graduates to field units, thereby placing an even greater burden upon the few highly skilled mechanics (i.e., the 20s and 30s) remaining in the unit. These actions were not properly coordinated and may have adversely affected the capability of DS and GS units to accomplish their missions.



APPENDIX B  
TRAINING OF MILITARY MECHANICS

BACKGROUND

Working Paper No. 2, "Training of Military Mechanics," was completed in May 1978. This working paper addressed training doctrine and its impact on maintenance unit capability. It also described the type and purpose of both individual and unit training.

INDIVIDUAL TRAINING

Advanced Individual Training

Advanced Individual Training (AIT) is provided to Army personnel upon completion of basic training. Most AIT courses for MOSs in support of tactical and combat equipment are taught at the U.S. Army Ordnance and Chemical Center and School. Current doctrine concerning the content and scope of these courses dictates that AIT instruction be limited to those critical tasks that: (1) cannot be effectively learned elsewhere, (2) are necessary for personnel safety, and (3) avoid equipment damage. The remaining tasks are to be learned through either OJT programs in field maintenance units or self-study.

The limiting of AIT instruction to a few critical tasks has had a far-reaching impact. The requirement to develop a comprehensive OJT program in field units has not been reflected in unit staffing. To develop and successfully execute such a program, more experienced supervisors are required. But they have not been assigned to the units.

Table B-1 illustrates this situation in two different types of units. Originally, these units were authorized only a few skill level 10

TABLE B-1. DISTRIBUTION OF SUPERVISORS AND DIRECT LABOR MECHANICS

Type TOE	TOE Issue Dates	Number of Mechanics	Number of Skill Level 10 Mechanics	Number of Maintenance Supervisors	Ratio: Skill Level 10 Supervisors
TOE 29-28H: Heavy Maint. Co., Maint. Bn., Inf. Division (M)	Original - Nov. 1970	168	32	13	2.5
	Latest - Mar. 1977	145	100	13	7.7
TOE 29-427H: Maint. Co. (DS), Theater Army Support Command	Original - Nov. 1974	171	14	18	0.8
	Latest - Sep. 1977	131	105	11	9.5

mechanics. Under the most recent TOE issue, however, most of the mechanics in the units are skill level 10. While the number of supervisors in these units has remained approximately the same, the ratio of skill level 10 mechanics to supervisors has changed dramatically. In the original TOE 29-28H issue, there were 2.5 skill level 10 mechanics for every supervisor; while in the later issue this ratio was 7.7:1, a threefold increase. The change in supervisory responsibility was even more dramatic in TOE 29-427H. In the original issue, there were 0.8 skill level 10 mechanics per supervisor; in the most recent issue, this ratio had increased twelvefold to 9.6:1. These changes in skill distribution and supervisory support were antithetical to what is needed to respond to increasing equipment complexity and to the need for increased mechanic skills to maintain the equipment.

OJT and Self-Study

TRADOC has prepared two packages of training material for enhancing the skills of Army mechanics assigned to field maintenance units. These are: (1) MOS manuals, which were designed to assist the unit training officer in preparing an OJT program that would more fully develop individual MOS skills; and (2) self-study packages, which were designed to assist individuals in developing MOS skills that they could not learn on the job because of their particular duty assignments.

The measure used to determine competence and eligibility for promotion is the Skill Qualification Test (SQT). The MOS manuals identify tasks which, if performed competently, increase the likelihood of a good SQT score. TRADOC's position is that field unit OJT programs should be oriented to assisting mechanics in passing the SQT. It is expected that many of the maintenance tasks which mechanics do not normally encounter in their duty positions will be covered during OJT.

Some of the maintenance tasks expected to be covered by the SQT are solely the responsibility of the individual. To aid the mechanic, TRADOC has developed self-study packages for each MOS. However, even if mechanics extend their training through the use of these packages, some can never be fully prepared for the SQT because their particular MOS is too broad (e.g., 63H Automotive Repairman). As a result, TRADOC is expected to permit selected portions of the SQT to be waived.

TRADOC has found the mechanic SQTs extremely difficult to develop and has postponed several testing dates. The SQT program was designed to replace the previous MOS testing procedure. But, as a result of the development problems, there has been no mechanic testing during the last few years.

#### UNIT TRAINING

TRADOC has developed an Army Training and Evaluation Program (ARTEP) to guide unit commanders in developing a peacetime training program that melds together the individual skills of the unit. ARTEP emphasis is placed on fundamental, frequently performed, mission-related tasks which are essential in combat.

The ARTEP serves as a reference document for TOE maintenance unit commanders, platoon leaders, and training officers in developing training plans.

It provides procedures and guidelines for monitoring and improving the learning progress of individuals and teams/squads. It also furnishes a means for identifying weaknesses in mission performance capabilities and provides the training officer with information for modifying or updating the training program.

The ARTEP is also used as a basis for unit commander or higher evaluation of a maintenance unit. During the evaluation, the unit is tested on the tactical and maintenance aspects of its mission while operating under conditions approximating a combat environment.

#### FIELD OBSERVATIONS

##### Training Guidance

FORSCOM maintenance units have placed considerably less emphasis and priority on OJT and unit training programs than is called for in Army training regulations, MOS manuals, and ARTEPs. FORSCOM training guidelines include implementation of standard Army training regulations and an annual training letter. These are general in nature and provide little specific guidance and direction to maintenance units.

The level of effort expended on individual and unit training is left to the judgment of installation, battalion, or unit commanders. FORSCOM does not monitor field training missions, programs, or practices.

##### OJT in Field Units

Each maintenance unit visited had some type of informal OJT program. However, most of the OJT resulted from normal support of equipment owned by customer units. None of the programs had the objective of developing the unit mechanics' skills in accordance with the TOE mission. There was little evidence that the TRADOC training aids were being used. It was apparent that maintenance training was not emphasized at any level of maintenance--the company, battalion, division, or installation.



Among the reasons given for the absence of a strong commitment to the TRADOC-developed OJT program are the following:

- Much of the equipment a soldier should be skilled in maintaining either is not owned by supported units or is evacuated directly to the TDA activity; mechanics, therefore, do not have the opportunity to work on that equipment.
- There is a shortage of skilled and experienced supervisors to conduct such a program.
- There is no pressure to develop skills other than those required to support available work; the SQTs have not yet been scheduled.

The conditions restricting the development of an effective OJT program are further complicated by the limited training received in AIT. Unit leaders have little faith in the graduates of many AIT schools. They believe that most graduates have difficulty functioning in the limited training environment that now exists, and it would be counterproductive to expose them to a wider variety of maintenance tasks. They also maintain that maximum benefits are achieved by restricting mechanics to the usual maintenance workload.

#### Unit Training

There is little evidence that the ARTEP is being used as a guide in preparing, evaluating, and modifying a continuing training program for a unit. The same reasons for the absence of a strong OJT program also apply to use of the ARTEP as a training aid.

The ARTEP is often inappropriately used for evaluating the capability of a unit to perform its TOE mission. In some cases, units are assessed only on their day-to-day maintenance responsibilities; in others, only military aspects of the mission are evaluated because the unit is assumed to be capable of supporting its maintenance mission. Therefore, it is possible that a unit may pass an ARTEP and still be incapable of performing its TOE maintenance mission.

Unit commanders seldom take the actions necessary to insure a maintenance capability outside their normal production responsibilities. Examples of actions which might assure more mission-related training are:

- Collocating the less skilled military mechanic with the more experienced civilian mechanic in the post maintenance activity.
- Relieving AIT school arrivals of special duties and classes unrelated to maintenance so that they can devote their full energy toward learning their MOS skills.
- Building mockups of nonavailable equipment to serve as training aids.
- Setting aside several days each week for training/maintenance only (no diversions permitted).
- Creating a second shift, on a rotating basis, to allow full attention to training/maintenance (unfettered by diversions).

Some units have initiated one or two of these measures; most have not. Guidance directing or even recommending such actions does not exist.

#### Impact of Training on Unit Capability

The action of TRADOC in limiting institutional training to certain "critical tasks" is not in itself significant. However, when considered in conjunction with (1) the increased number of less skilled mechanics in TOE units, (2) the greater maintenance responsibility placed on entry-level mechanics (i.e., skill level 10), and (3) the increased ratio of entry-level mechanics to supervisors, the impact of this action is very significant.

Though cost was a factor in the TRADOC action, the cost of not training entry-level mechanics to perform at a higher level of competence was not adequately evaluated. The primary peacetime objective of DS and GS maintenance units is to train for war, i.e., develop a capability to perform their TOE missions. Any production (i.e., repair of end items, assemblies, and

components) realized in the accomplishment of this objective should be considered a by-product. However, in today's environment the opposite is true. Mechanic training is a by-product of production, which is usually the extent of the training program.

## APPENDIX C

### CAPABILITY AND EFFECTIVENESS OF CONUS UNITS

#### BACKGROUND

Working Paper No. 3, "Capability and Effectiveness of CONUS Units," was completed in June 1978. This working paper presented findings on: (1) the capability of CONUS-based DS and GS maintenance units to satisfy wartime requirements, and (2) the effectiveness of the maintenance personnel assigned to these units.

#### DS UNIT PERFORMANCE

The review of DS maintenance units encountered considerable difficulty in identifying the work actually accomplished. The difficulty arose because most units were not supported by production control systems which provided sufficient historical performance information.

Even though each of the divisional maintenance battalions visited used the Maintenance Control System, the summary reports were very narrow. Repair times could not be associated with specific jobs nor could the type of repairs performed be identified. Unit performance data for nondivisional maintenance companies were even more restrictive, allowing little visibility of completed work other than through examination of individual work orders.

The limited visibility of DS unit performance forced the review of these units to concentrate on the maintenance not being performed. This consisted of: (1) workload evacuated to post maintenance, and (2) nonsupport of DX repairable items. Overall, we observed few consistent and reliable indicators that DS maintenance units are not capable of their remove-and-replace mission. For every unit that relied heavily upon post maintenance for backup DS or did



not support the DX program, a similar type unit was observed that evacuated very little DS work and repaired all its DX items.

It is common practice for nondivisional DS units to be assigned peacetime missions at variance with their wartime missions. The TOE mission statements for these units call for assignment at the corps level, providing DS maintenance on corps equipment and backup DS to divisional maintenance battalions. Yet, many of these units do not support any combat element during peacetime. Thus, the tracked vehicle mechanics, artillery repairmen, turret mechanics, and fire control repairmen (to name a few) in these units have little opportunity to develop their skills.

Despite this conflict between the peacetime and wartime mission assignments of nondivisional DS units, no initiatives have been taken to lessen the impact. Training programs have not been established so that assigned mechanics may receive training on equipment not routinely available to the unit.

Military DS units were often not permitted to support specific equipment/components, even though the units had the mission, trained mechanics, and facilities. The primary reason given was "post maintenance has always had this responsibility." The specific DS mission areas involved include fire control equipment, turrets, communications equipment, and range finders. At some installations, historical practices have just been carried forward; while at others, retaining civilian mechanic positions seems to be the primary cause.

#### GS UNIT PERFORMANCE

The primary indicators of GS unit performance were the production and training programs. The evaluation considered the actual performance of several GS units in overhauling major tactical and combat vehicle assemblies

with emphasis on support of assemblies identified by FORSCOM as reportable at the GS level. This evaluation was followed by contrasting unit production, experience, and training with TOE mission requirements.

The analysis focused on companies organized under two separate TOEs:

- TOE 29-427H; Maintenance Company, Theater Army Support Command, DS/GS
- TOE 29-137H; Heavy Equipment Maintenance (HEM) Company, GS

One of the companies reviewed had no GS mission, and production data showed that two others spent only 10 and 22 percent of their direct labor hours in GS level support. Those companies that were performing GS level tasks tended to concentrate their maintenance resources on a limited number of assemblies. For example, in one company, 90 percent of the direct labor hours spent on GS level maintenance were in support of the M151A1 engine, transmission, and differential; in a second company, 87 percent of the direct labor hours devoted to GS level maintenance were in support of the M54A2 and M113A1 engines.

With one exception, the peacetime missions of the units visited, are local installation assignments. FORSCOM Headquarters is not an active participant in these assignments.

Some units have initiated programs which assign military mechanics to OJT at post maintenance, but these are limited efforts. No unit has established a training program to expand its peacetime mission to additional assemblies.

There are strong doubts about the capability of CONUS based GS HEM companies to accomplish their wartime mission. Peacetime mission assignments and local management practices appear to be major deterrents to achieving such a capability. In many cases, GS units do not have a peacetime workload beyond

less complex components and assemblies because of the added training required by the military mechanics. The AIT schools are not geared to produce skilled GS-level mechanics; GS-level skills must be developed through OJT in field units. This requires considerable supervision for an extended period.

One company at Fort Hood has demonstrated (in the field test of RGS) that military mechanics can support the repair of complex assemblies. However, this capability was not easily achieved. In anticipation of their RGS test assignment, many mechanics were already working closely with civilian post maintenance mechanics. When the RGS assignment was made, most unit personnel were exempted from nonmaintenance requirements and given an intensive six-week training assignment under the supervision of post maintenance mechanics. Unit supervisors and mechanics were frozen in their positions, thereby lessening the impact of turnover. Thus, the capability enhancement of this company required a dedicated effort by the unit, the post maintenance activity, the division, and the corps. Similar efforts will be required if other GS companies are to enhance their repair capability. Such an effort requires top-level interest and dedication.

#### MECHANIC AVAILABILITY/UTILIZATION

The evaluation of unit effectiveness focused on how well mechanics assigned to maintenance units are being used. The primary indicators of unit effectiveness are the mechanic availability rate and the mechanic utilization rate. The availability rate is defined as the percent of a standard reporting period (i.e., 8-hour day, 40-hour week) that each direct labor mechanic, assigned to the unit, is available in the shop for maintenance duties. The mechanic utilization rate is defined as the percent of a standard reporting period that each direct labor mechanic assigned to a unit is actually performing maintenance.

The availability and utilization rates of the units reviewed showed a wide variation, ranging between 26 and 113 percent for availability and 10 and 26 percent for utilization. Availability reporting indicated either significant inaccuracies or differences in interpretation of the reporting requirements. Low personnel utilization was caused by other factors.

Unit readiness reporting dictates many of the maintenance practices at CONUS installations. If high equipment readiness is reported by supported units, there is little pressure on the maintenance organization to improve its performance. According to the primary indicator of unit performance at these installations, the unit is already viewed as being highly effective.

It has been argued that low mechanic utilization results from (1) ease of evacuating work to backup units, (2) retention of significant workload by post maintenance, and (3) heavy reliance on the supply system for replacing components or assemblies rather than repairing them locally. These are management-initiated practices, rather than unavoidable causes of low utilization; they simply enable maintenance units to support equipment at a reportedly high level of readiness with minimal mechanic time in the shop.

Few unit, battalion, or post commanders exhibited a strong interest in assuring the planned level of mechanics' skills of their maintenance personnel. Mechanics are commonly treated simply as a manpower resource; if supported equipment is reported fully ready, there is little interest in their application to maintenance tasks.



## APPENDIX D

### CAPABILITY AND EFFECTIVENESS OF USAREUR UNITS

#### BACKGROUND

Working Paper No. 4, "Capability and Effectiveness of USAREUR Units," was completed in October 1978. This working paper presented findings on (1) the capability of USAREUR DS and GS maintenance units to satisfy wartime requirements, and (2) the effectiveness of the maintenance personnel assigned to these units.

#### UNIT PERFORMANCE

All nondivisional DS and GS maintenance units in USAREUR report and manage their maintenance function through the Tactical Maintenance Control System (TMCS). Divisional maintenance battalions use the Maintenance Control System, which differs from TMCS only in the manner that command and headquarters summaries are developed.

Evaluation of the capability of divisional maintenance battalions focused on observations, discussions with battalion personnel, and review of evacuated workload. We found no indication that divisional maintenance battalions are not capable of performing their remove-and-replace functions.

An analysis of production data on combat vehicles was made for four nondivisional DS units. The analysis indicated that the maintenance performed by mechanics with combat-vehicle-related MOSs consisted of about one hour per week in two units and four and sixteen hours per week in the other units. Based on the complexities of combat vehicle maintenance, mechanics in the first two units are barely receiving an introduction to combat equipment. Training programs have not been established to compensate for this situation.

Production data indicated that TOE GS units mostly support tactical vehicle components. However, these units are concentrating on a few simple components and are not obtaining a broad exposure. Many of the complex components are not being supported. For the units sampled, the Gamma Goat engine is the only tactical vehicle engine being supported by TOE mechanics, and that only by one unit. Conversely, the less complex components are widely supported by TOE mechanics.

Analysis of TOE GS unit production in support of combat vehicles indicated that not one unit sampled was supporting major components and assemblies. Specifically, no unit is supporting combat vehicle engines, transmissions, transfers, or final drives. Some of the minor components are being maintained, but even that support is limited.

Two maintenance factors necessary for successfully implementing the fix forward concept at the GS level are: (1) extensive end-item diagnostic capability, and (2) a quick component remove-and-replace capability, essentially a DS mission. Both must be exercised in peacetime to ensure adequate capability during wartime. Although neither the diagnostic capability nor the component remove-and-replace capability were directly measured, an indication of those capabilities may be inferred from the amount of exposure these units received on combat and tactical vehicle end items.

There are five area GS and five CRE GS companies in USAREUR; eight were visited by the study team. Two units have a limited backup DS mission which may be a indication of some fix forward capability. Another unit is primarily involved with a component rebuild program and does virtually no end-item work. Production data on the remaining five units indicated that three were receiving significant exposure to tactical vehicle end items (averaging from 5 to 22 hours per week per mechanic) while the other two were receiving no exposure.

The situation is dramatically different when combat vehicle end items are considered. Only one unit was exposed to combat vehicle end items. Every mechanic in this unit with a combat-vehicle-related MOS was averaging six hours of direct labor time per week on combat vehicles. Mechanics with similar MOSs in the remaining units did not receive any experience on combat vehicle end items.

No unit has established a training program aimed at compensating for the deficiencies noted above. Without such a program, given the limited exposure to tactical vehicles and virtually no exposure to combat vehicles, the capability of GS units to serve adequately in the fix forward role is doubtful.

#### UNIT EFFECTIVENESS

The evaluation of unit effectiveness focused on how well mechanics in USAREUR TOE maintenance units were being used. As with CONUS units, the primary indicators of unit effectiveness were mechanic availability and mechanic utilization.

Nondivisional DS mechanics were found to be available for maintenance almost 5 hours per day, while GS mechanics were available 4 1/2 hours per day. The productive utilization of nondivisional mechanics was low--DS units averaged almost 1 1/2 hours per day of productive maintenance per mechanic, while GS units averaged slightly more than 1 3/4 hours per day.

While the availability and utilization rates of USAREUR mechanics do not vary as widely as similar rates for mechanics in CONUS units, they are very consistent with CONUS findings.

#### OTHER FACTORS

There were several factors observed in USAREUR which are germane to the overall capability and effectiveness of USAREUR maintenance units but which do not conveniently fit into the discussion of unit capability and effectiveness. These are briefly noted in the following paragraphs.

The FY 1979 TARP provides for 1.5 million man-hours of GS-level maintenance, of which almost 0.9 million are in the tactical and combat equipment categories (both end items and components). Approximately 86 percent of the total TARP workload is performed by foreign-national-staffed organizations. Assuming a proportional application across equipment categories of foreign-national labor, almost 0.8 million man-hours of such labor are in support of combat and tactical vehicles.

The Mainz Depot, a DARCOM installation, has the primary theater mission for combat vehicle support. Its annual contract calls for approximately 2.5 million man-hours. This production capability, when coupled with USAREUR civilian activity support of the TARP, yields 3.3 million man-hours of foreign-national-staffed support for combat and tactical vehicles above the DS level.

By contrast, TOE GS units add little to this capacity. The man-hours of direct labor applied to combat and tactical vehicles for the eight GS units visited amounted to 0.34 million man-hours. But since this includes DS as well as GS level support, the actual GS capacity of these military units is even less. Extending this productive capacity over the two units not visited results in an estimated TOE unit total of 0.47 million man-hours--just one-seventh the productive capacity of the foreign-national-staffed support organizations.

The FY 1979 TARP provides for more than 0.4 million man-hours for component repair in the tactical and combat equipment categories. Nearly half of these component man-hours are for tactical vehicles, but TOE GS units support only a small percentage. Foreign-national-staffed units are supporting the major portion of the component repair work.



We have already noted that combat vehicle components and assemblies are not being supported by TOE GS units. Since there are no combat vehicle components in the 1979 TARP, it is logical to assume that the Mainz Army Depot is either performing GS level repairs on these components/assemblies or performing depot-level repairs to satisfy a GS requirement.

Local practices contributed to degradation of GS-level component repair capability in TOE units. This is borne out by the emphasis on maximizing production, which has resulted in the specialization of the TOE GS units. Another factor contributing to that degradation is that existing funding policies encourage the commands to obtain "free" components from the supply system, rather than repair unserviceables with command resources.

## APPENDIX E

### CAPABILITY OF USAR AND ARNG UNITS

#### BACKGROUND

Working Paper No. 5, "Capability of USAR and ARNG Units," was completed in April 1979. This working paper addresses those factors which influence the wartime capability of USAR and ARNG maintenance units.

#### PERSONNEL CONDITIONS

The current status of RC maintenance units is illustrated by the reported unit readiness ratings:

- 66 percent are totally incapable of performing their mission
- 25 percent are capable with major limitations
- 9 percent are capable with minor limitations
- none are fully capable

Personnel shortages are the most commonly cited limitation in unit capability. Personnel levels are indicative of strength and qualification conditions. As shown in Table E-1, USAR units average 68 percent of MTOE strength, ARNG nondivisional units average 78 percent, and ARNG divisional units average 83 percent. These figures indicate an average USAR personnel readiness condition of "totally incapable" and an average ARNG personnel readiness condition of "capable with major limitations."

The average annual turnover rate for USAR units is 40 percent, the equivalent of a total change in personnel every 2½ years. For nondivisional and divisional ARNG units, the turnover rates are 23 and 32 percent, or a total changeover every 4.3 and 3 years, respectively.

TABLE E-1. PERSONNEL FILL AND TURNOVER RATES

Type of Unit	No. of Units	Current Fill <sup>a</sup>		Annual Turnover <sup>b</sup>	
		Average	Range	Average	Range
<u>Nondivisional Company</u>					
USAR	14	68%	30% - 99%	40%	20% - 82%
ARNG	16	78%	54% - 98%	23%	4% - 40%
<u>Divisional Battalion</u>					
ARNG	4	83%	80% - 87%	32%	28% - 38%

<sup>a</sup>Percent of full TOE/MTOE.

<sup>b</sup>Annualized turnover based on gross losses for six months as a percent of operating strength.

The training readiness rating indicates the amount of time required, upon mobilization, for a unit to become fully capable. The Army's current assessment is that 75 percent of the divisional units require five to six weeks of intensive, training while 25 percent require three to four weeks. For non-divisional units, the training readiness ratings indicate that 3 percent require only one week, 23 percent require two weeks, 37 percent require three to four weeks, and another 37 percent require five to six weeks. Personnel shortages are reported as the reason for two-thirds of the units not being fully trained.

In addition to personnel strength and stability, the technical capability of individual members is critical to unit readiness ratings. This capability is currently indicated by the number of MOS-qualified personnel. There are various criteria by which individuals can be considered MOS-qualified. Examples are:

- successful completion of an MOS course at an Active Army school
- at least 6 months of unit membership
- comparable civilian occupation

The decision on MOS qualification is made by the unit commander; it is highly subjective, and the criteria are variously interpreted. The unit percentage of MOS qualification reported by nondivisional companies indicates that 60 percent of USAR and 65 percent of ARNG unit MTOE strength is MOS-qualified. Battalions report 71 percent MOS-qualified. These figures equate to 89, 84, and 86 percent, respectively, of the average actual strength of the units.

Dual-status maintenance technicians, who must be members of RC units as a condition of employment, constitute a key segment of MOS-qualified personnel. On the average, there are two to three dual-status personnel in USAR units and 29 in nondivisional ARNG units.

#### MANAGEMENT FACTORS

Several management factors could materially affect the capability of RC maintenance units. The most significant are organization and location.

Organizational structures differ appreciably between the USAR and ARNG. The ARNG is configured in peacetime according to wartime doctrine, i.e., maintenance companies always report to maintenance battalions. The USAR, on the other hand, is generally not functionally organized. The peacetime organization is geographic, although some major commands are functionally oriented. As a result, one in three USAR units does not report to a maintenance-oriented battalion.

There are other organizational differences. The maintenance structure in each state militia is a closed system. ARNG maintenance is characterized by DS/GS maintenance facilities, more workload, access to repair parts, dual-status technicians, and central management control. In the USAR, DS/GS maintenance is the responsibility of Active Army posts; DS/GS facilities,



workload, repair parts, and management control are outside the USAR organization.

Location is an important factor in unit capability because of mission related training workload during IDT. The key is the distance of the potential workload to the unit's home station. Table E-2 shows that ARNG units tend to be closer to DS/GS facilities than USAR units.

TABLE E-2. CURRENT ACCESSIBILITY TO DS/GS WORKLOAD

Distance from Assigned/Potential <sup>a</sup> DS/GS Facilities	No. of Units <sup>b</sup>	
	USAR	ARNG
Collocated with DS/GS Facility	0	7
Located within Same City as DS/GS Facility	4	5
Beyond City Limits of DS/GS Facility, But:		
- Less than 50 miles	1	9
- 50-100 miles	1	4
- 100-150 miles	3	5
- Greater than 150 miles	4	1
Total Number of Units	13	31

<sup>a</sup>No consideration was given to nature of work potentially available.

<sup>b</sup>Companies in divisional battalions counted separately.

### MAINTENANCE TRAINING

#### Availability for Training

RC units have a maximum potential of 280 hours (35 days) of training annually.<sup>1</sup> This includes 192 IDT hours and 88 AT hours.

During IDT, maintenance units can typically count on seven weekends, annually, to be available for maintenance training. The remainder is lost to military training, preparation for inspections, and administrative duties.

<sup>1</sup>This is 14 percent of the training time available for Active Army units.

During AT, the time available for maintenance training varies according to the training format. Some AT formats require maintenance units to perform support roles in a field environment which includes tactical maneuvers and other military duties. This type of AT allows limited time for maintenance training. Other AT formats, such as at depots and schools, provide for a relatively large amount of maintenance training. Still other formats, such as training alongside Active Army units, provide a moderate amount of maintenance training time. This results in an average of eight days of maintenance training during AT, which, together with the IDT time available for maintenance training, yields 22 days per year.

Scope of Technical Training

Table E-3 illustrates the magnitude of maintenance unit training requirements. Two maintenance units have been examined in detail. One, a forward DS company, supports a relatively narrow range of equipment. The other, a rear DS company, supports a much wider range of equipment.

TABLE E-3. ILLUSTRATION OF POTENTIAL TRAINING SCOPE

TOE No.	Type Unit	TOE Strength	No. of MOS	Direct Labor Mechanic	Mechanic <sup>a</sup> Supervisors		Maint. MOS	Low <sup>b</sup> Density Maint. MOS
					No.	Ratio		
29-207H	Fwd. DS Co.	215	48	123	16	1: 7.7	21	14
29-208H	Rear DS Co.	273	60	163	16	1:10.2	34	24

<sup>a</sup>Includes warrant officer and supervisory positions in the maintenance sections and inspectors in the maintenance control section.

<sup>b</sup>Maintenance MOSs, at all grades, with less than five authorized positions.

This table shows that there are 60 different enlisted MOSs in a rear DS company. Of these MOSs, 34 are maintenance-related, 24 of which are low-density. (In contrast, armor and infantry companies have 9 or 10 MOSs, with 2 or 3 being low-density.) There are 16 maintenance supervisors and 163 direct labor mechanics in the rear DS company, a ratio of 1 supervisor to 10 direct workers. Similar, but less dramatic, results are displayed for the forward DS company.

In contrast to just a few years ago, the training requirement placed upon the maintenance supervisor is significant. Not only are the supervisors responsible for more entry-level mechanics, but they have also been assigned a specific training role for those mechanics.

#### Nature of IDT Training

There are a variety of ways by which units can train. The most common are self-study, home station lectures and demonstrations, external schools, and hands-on training. Of these, hands-on training is the most effective. Yet, opportunities for hands-on training are extremely limited.

Many organizations have established programs to provide hands-on training for mechanics during IDT. These all appear sound, but their actual effectiveness is mixed, often disappointing. Most result in some work for selected sections, but for a limited duration. Most work is obtained through personal contacts. Some organizations have considerable difficulty in getting a particular type of training workload, while that same type of workload is readily available elsewhere. There is no system, or institutional plan, which consistently provides workload of the volume and variety necessary to be of significant training value to an entire unit on a regular basis.

Nondivisional units are experiencing mixed success in obtaining hands-on training during IDT. Combat vehicle work is rarely encountered by



ARNG units and never by USAR units. All units have several low-density MOSs which seldom receive any hands-on training.

Few GS units are doing any component rebuild during IDT. Experience on combat vehicle power train components is rare although a few units have been exposed to tactical vehicle (especially  $\frac{1}{2}$ -ton and  $2\frac{1}{2}$ -ton) power train components. In many cases, the time-consuming nature of much of this type work precludes it from being performed during IDT.

In general, divisional maintenance battalions are receiving some hands-on training during IDT, though the volume and variety was not determined.

There are many factors which contribute to the limitations in the amount of hands-on training available during IDT. Among the more significant are unit location, management, training time, and cooperation. In some cases, these factors independently present obstacles to training workload; in others, a combination of factors inhibits training opportunities. For example, a lack of cooperation is frequently evident because the training workload potentially available represents a maintenance workload justifying full-time civilian mechanic positions. Another example is that the unit owning equipment in need of repair is reluctant to allow RC units to perform the required maintenance because the equipment is needed immediately either to sustain acceptable equipment readiness rates or for training purposes. In either case, an extended repair cycle or the risk of improper maintenance tends to stifle the cooperation of the owning unit. This situation is further compounded by mechanic inexperience and by either an insufficient amount of uninterrupted maintenance time or discontinuity of repair teams.

#### Nature of AT

The nature and extent of hands-on training during AT varies widely, depending upon both the training mission of the unit and the training format.



Divisional maintenance battalions are given the mission of supporting their division, so the nature of their workload is similar to their TOE mission.

Nondivisional units in the support role format at AT usually get some maintenance workload. Often it is organizational-level maintenance, but a large share is also DS work. Combat vehicle DS work is obtained infrequently; however, tactical vehicle DS work is commonly experienced. Equipment failures requiring GS-level repairs almost never occur during AT; if they do, the work is set aside because it is too lengthy to finish during the AT period.

In this format, GS HEM and TASCOM DS/GS companies are always employed in DS roles, while GS LEM companies are not assigned this type of AT. Low density MOSs rarely receive hands-on training; sometimes, these MOSs are sent elsewhere.

In the training format which calls for RC units to train with Active units, the nature and extent of the hands-on training is a direct function of the Active unit's workload. Since the Active unit workload varies from location to location, the training received by the Reserve Component unit also varies. Most Active Army nondivisional units in CONUS do not have peacetime missions which exercise the full range of their TOE. Combat vehicle and artillery work is often lacking as is work for low-density MOSs.

Holding AT at depots is relevant only for GS units. Although the training potential for GS units at depots is high, the results are mixed. Some units experienced valuable training while others claimed that they were either relegated to menial tasks or assigned to the same operation with little variety. Due to the specialized workload of most depots, all sections of the company do not have a meaningful training opportunity.

## COMPARISON OF THE RESERVE COMPONENTS

ARNG units are more capable than comparable USAR units. ARNG units fare considerably better at recruiting and retention; fill rates are higher and turnover much less severe. The capability of ARNG units is enhanced considerably by the expertise of the dual-status technicians which outnumber those in USAR units by 13 to 1. The USAR organization is fragmented with many overlapping areas of control and conflicting interests, whereas the nature of the ARNG structure provides for the potential DS/GS workload, facilities, and parts. Similar circumstances are rarely true for USAR units.

## UNIT EVALUATION

Current management indicators do not provide adequate information for determining the true capability of RC maintenance units. The reports of IG inspections provide no information about the units primary maintenance mission. Command Logistics Review Team and Command Evaluation Team evaluations only determine the ability of the unit to maintain organic equipment at the organizational level. The report of annual training is aimed almost exclusively at units' tactical abilities. The CONUSA evaluations of IDT training effectiveness provide a snapshot of the mission training currently being conducted but they do not address technical capability.

Unit status reports provide only a very broad indication of unit capability. They rely on unit equipment status, personnel strengths, percentage of MOS-qualified personnel, and the amount of training required as indicators of the technical ability of the unit. They provide no information about the kind and quality of technical training received by the units nor do they address strengths inherent in unit personnel such as dual status technicians.

### FUTURE PROGNOSIS

Under present circumstances, RC maintenance units cannot achieve and sustain a full mission capability in peacetime, even if strength levels reach 100 percent.

The annual turnover rate in USAR units is 40 percent which implies that the typical mechanic (the median) is in the unit less than 2½ years. During this period, he will receive an average of 2½ months of fragmented intermittent training. Conditions in the ARNG are slightly better. Yet, it is universally held by Active Army field personnel, that it takes at least 3 months of OJT, in addition to AIT, to produce a minimally capable mechanic. Under these and other conditions previously described, it is virtually impossible for a mechanic or his unit to achieve the readiness levels demanded for wartime.

## APPENDIX F

### ABBREVIATIONS AND ACRONYMS

AG	- adjutant general
AIT	- advanced institutional training
AMMH	- annual maintenance man-hours
AMSA	- area maintenance support activity
ARCOM	- Army Reserve Command
ARNG	- Army National Guard
ARR	- Army readiness region
ARTEP	- Army Training and Evaluation Program
ASB	- area support battalion
AT	- annual training
ATC	- Army training command
COMMZ	- communications zone
CONUS	- Continental United States
CONUSA	- Continental U.S. Army
COSCOM	- corps support command
CRE	- collection, reclamation, and exchange
CSMS	- combined support maintenance shop
DA	- Department of the Army
DARCOM	- U.S. Army Development and Readiness Command
DISCOM	- division support command
DS	- direct support
DX	- direct exchange
FORSCOM	- U.S. Army Forces Command
GOCOM	- General Officer Command
GS	- general support
HEM	- Heavy Equipment Maintenance
IDT	- inactive duty training
LAD	- latest arrival date (in theater)
LEM	- Light Equipment Maintenance
MAC	- maintenance allocation chart
MACRIT	- manpower authorization criteria
MILPERCEN	- U.S. Army Military Personnel Center
MMC	- materiel management center
MOS	- military occupational specialty
MTOE	- Modification Table of Organization and Equipment
MUSARC	- Major U.S. Army Reserve Command
NCO	- non-commissioned officer
NGB	- National Guard Bureau
OJT	- on-the-job training
OMS	- organizational maintenance shop
RC	- Reserve Components
RG	- readiness group
RGS	- Restructured General Support
SMO	- state maintenance officer
SQT	- skill qualification test



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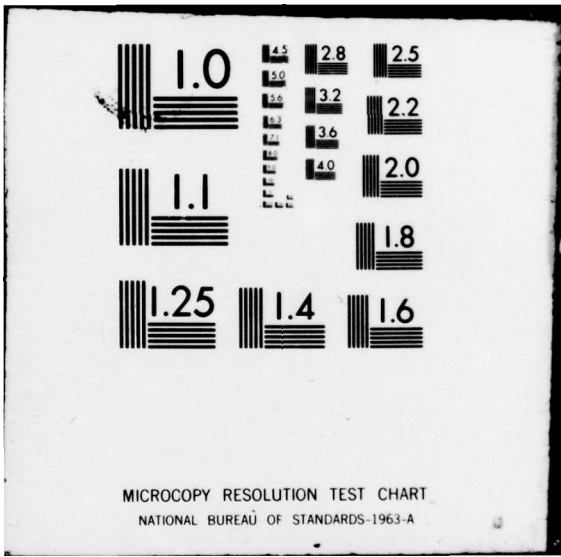


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SRA - specialized repair activity  
SUIP - Support Unit Improvement Program  
SUPCOM - support command  
TARP - Theater Army Repair Program  
TASCOM - Theater Army Support Command  
TDA - Table of Distribution and Allowances  
TOE - Table of Organization and Equipment  
TRADOC - U.S. Army Training and Doctrine Command  
UMMC - USAREUR Material Management Center  
USAR - U.S. Army Reserve  
USAREUR - U.S. Army Europe

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Combat and Tactical Vehicle Maintenance in the Army		5. TYPE OF REPORT & PERIOD COVERED
7. AUTHOR(s) Eugene A. Narragon Jerome M. Neil Joseph R. Wilk		6. PERFORMING ORG. REPORT NUMBER LMI Task ML804
9. PERFORMING ORGANIZATION NAME AND ADDRESS Logistics Management Institute 4701 Sangamore Road Washington, D.C. 20016		8. CONTRACT OR GRANT NUMBER(s) MDA 903-77-C0370
11. CONTROLLING OFFICE NAME AND ADDRESS Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics)		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE June 1979
		13. NUMBER OF PAGES 102
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)  "A" Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  Maintenance, Direct Support, General Support, Maintenance Effectiveness, Maintenance Capability, Mechanic Training		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This study reviews the capability of direct and general support maintenance units to satisfy wartime requirements. Units assigned to the Forces Command, Europe, Army Reserve, and the Army National Guard were included in the evaluation.  Active Army DS units are generally capable of performing at their planned wartime level. Several nondivisional units are not receiving the necessary experience on some equipment. It is recommended that the Army realign maintenance		

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support missions so that those units maintain equipment they will support during wartime.

Active Army GS units are unprepared for wartime. Many units are not performing GS-level repairs, those that do concentrate on easier, tactical vehicle components. Few units receive any exposure to end items, especially combat vehicles. It is recommended that the Army establish a Mechanic Enhancement Program for GS-level mechanics. That program integrates apprentice training, improved workload and missions for active units, and advanced technician training for experienced GS mechanics.

The readiness of maintenance units in the Reserve and Guard is lower than reported. Personnel shortage is often cited as the primary reason for the present low status. However, the high personnel turnover, the few hours available each year for maintenance training, and the paucity of hands-on maintenance opportunities suggest that even if those units are fully staffed, most would still be incapable of maintaining Army equipment. We recommend that the Army undertake a comprehensive evaluation of all Reserve and Guard maintenance units. The purpose of that evaluation is to identify those units that presently are the most capable, and have the potential to retain that capability over many years. Only those units should be assigned early latest arrival dates. They also should be accorded special priority for workload opportunities and training programs.

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