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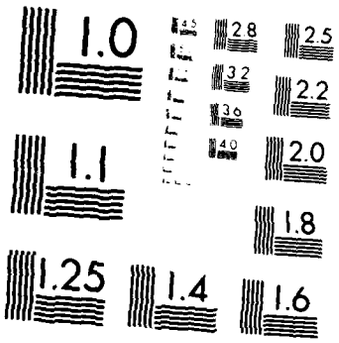

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Currently, Direct Support (DS) maintenance TOE units lack a viable structure for quality control operations and management. Moreover, there is a lack of consensus within the doctrinal and personnel communities regarding the training required or the force structure necessary to effectively operate a quality management program at the DS level. The ambiguity in maintenance inspection standards, inconsistency among various technical inspectors and the impact of developmental and fielding policies concerning Test Measurement and

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USAWC MILITARY STUDIES PROGRAM

MAINTENANCE QUALITY CONTROL: A CRITICAL APPRAISAL

INDIVIDUAL ESSAY

by

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ABSTRACT

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Currently, Direct Support (DS) maintenance TOE units lack a viable structure for quality control operations and management. Moreover, there is a lack of consensus within the doctrinal and personnel communities regarding the training required or the force structure necessary to effectively operate a quality management program at the DS level. The ambiguity in maintenance inspection standards, inconsistency among various technical inspectors and the impact of developmental and fielding policies concerning Test Measurement and Diagnostic Equipment (TMDE) is also examined relative to the conduct of sound quality and production management practices. Data was gathered through technical literature searches, discussions with representatives in TRADOC and DA, and the author's personal experience. An alternative approach to quality management is proposed in the interpretation and application of sound maintenance standards, conduct of in-house and TRADOC training programs, development of TMDE and special tools, and the greater utilization of warrant officers in the role of quality managers.

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INTRODUCTION

The full page color advertisement in a national magazine pictures a group of white coated technicians gathered around a partially completed automobile. Their title: "Flaw Fighters." The bold caption at the bottom of the page: "Quality is Job 1" followed by a Ford Motor Company logo. Read further and you discover the thrust of Ford's advertisement: convince the public that their goal is to build the highest quality cars and trucks in the world.

This recent drive for quality is starting to receive considerable attention throughout the automobile industry and was credited as a major factor in the decision of the big three US automakers to delay the introduction of many 1983 models. Criticized at first by some marketing managers, the action is now being praised by corporate analysts and workers alike as a step in the right direction. Driven initially by a necessity to match the quality of foreign imports and erase the American public's perception of shoddy workmenship, top management is now anticipating that tightened quality standards may save production costs over time, because recalls will be reduced and production lines will be disrupted less frequently.

Emphasis on management of the quality function is also emerging in other phases of industry. Chevrolet's Mr. Goodwrench is portrayed as a skilled technician who knows maintenance standards and will utilize all available means to see that repairs are performed efficiently, effectively, and in compliance with established standards. Household appliance manufacturers are producing a series of "how-to" booklets to aid owner repair.

One company even offers a telephone hot line to assist owners during their fault diagnosis and repair. While improved sales is an obvious motive in both examples one must also conclude that a large segment of our economy is moving more toward a service industry. The public is seeking a better product at the outset, they intend to keep it longer, and they plan to maintain it better by entrusting repairs to someone they can believe in or by doing the work themselves. Thus, demands for accurate standards, effective fault diagnosis and quality control are now being reflected during the normal maintenance and repair phase as well as the production process.

With the ever increasing complexity and cost of the Army's new weapon's systems and the need to retain many vintage series of equipment in the inventory, why then has the Army not picked up on the quality revolution now taking root in industry? Profit motivates civilian industry to become concerned with quality management; a motivator not available to Army leadership. But what greater motivator can an organization have than the charge to maintain combat readiness and avoid the very real possibility of loss of lives and battles? Unfortunately, these considerations often disappear during peacetime and fault diagnosis and quality control tend to become subjects of abstract and somewhat philosophical discussions. However, there is ample evidence that equipment maintenance is susceptible to improvement, and the improvement and intensification of diagnostic and quality control procedures being followed in the field represent a large part of the answer.

BACKGROUND

Problems associated with the maintenance of Army equipment cover a variety of areas. Most often cited items include: inexperienced or poorly trained repairmen, lack of adequate and effective supervision, lack of

command emphasis on maintenance, shortage of required repair parts and/or special tools, poorly defined maintenance inspection standards, ineffectiveness of or failure to use available Test Measurement and Diagnostic Equipment (TMDE), and undue emphasis on production volume. Additionally, there are intangible factors to be considered such as the level of morale and motivation that may be affected by MOS structures involving grade progression, promotion policies and organizational structures that are not compatible with mission requirements.

The foregoing leads to an examination of the Army's current Quality Control system and its impact on the factors cited above. A quick appraisal reveals that the term quality control is virtually nonexistent in Tables of Organization and Equipment (TOE) covering Direct Support (DS) maintenance and organizational maintenance. Moreover, quality control is not emphasized in doctrinal publications. References to technical inspection or quality control do not acknowledge the range of materiel subject to maintenance or the differences in procedures and techniques required by variances in the nature of materiel. Thus, the present system excludes adequate consideration of quality control and fails to consider an extensive range of materiel that is both maintenance significant and combat essential. By far the most complete guide to methods, procedures and quality management at the field maintenance level is TM 750-19, which was published in 1973. Unfortunately, surveys conducted by the US Army Ordnance Center and School reveal a general lack of knowledge of its provisions and a universal failure to follow inspection forms prescribed by the pamphlet.[1]

EXISTING QUALITY CONTROL SYSTEMS

An examination of Army quality control systems in being in non-general equipment maintenance areas reveal several examples. The most formal

system applicable to field maintenance is in aircraft maintenance. Specific MOSs are devoted to quality control and fault diagnosis which permits specialization by type aircraft, allows for grade progression and provides training designed to ensure competence in performing quality management functions.[2] Aircraft inspectors may declare that an aircraft will not be flown until noted defects or irregularities have been corrected and these same inspectors are deeply involved in assuring the adequacy of maintenance being performed. Maintenance of missile equipment has also been examined with a view toward correcting TOE inconsistencies and MOS structure inadequacies.[3] While not formalized to the extent of aircraft inspections, missile quality control is more formal than systems employed in general equipment maintenance.

Examination of the depot maintenance complex reveals a highly formal, strictly controlled inspection and quality management program comparable to that found in civilian industry. Sophisticated equipment and facilities, not available to field units, are common practice. In addition, quality control functions are staffed by well trained personnel, usually civilian, dedicated to this single area of improving maintenance procedures, processes and techniques. In sum, depot maintenance includes a highly formal approach to quality management and is specifically tailored to existing facilities and the type of materiel being overhauled or repaired.

A review of maintenance procedures governing ammunition indicates a surveillance and quality control program which places responsibilities on all units and activities responsible for the receipt, storage, maintenance and issue of ammunition materiel. While ammunition is not "maintained" in the same sense as general equipment, it is clear that a structure exists to detect deviations from established quality characteristics, identify the cause of the deviation and initiate corrective action.[4]

The various quality control systems identified above provide the basis for a point of departure in establishing elements of a formal diagnostic and quality management program adaptable to general equipment found in most Army TOE units.

DEFINING STANDARDS

Establishing maintenance inspection standards and acceptable quality levels for maintenance already performed is one of the most controversial issues existing in today's Army in the field. Commanders and maintenance supervisors have expressed widespread dissatisfaction with maintenance standards imposed by their Maintenance Evaluation Team (MET), Inspector General (IG) and to a lesser extent their supporting DS maintenance battalion. There exists a perception among many commanders that they do not have the expertise in their units to successfully prepare them to pass a MET or IG maintenance inspection and/or that the inspection standards are unrealistic. As a result of similar discussions among division commanders in US Army Europe a "shoot out" was conducted among the various MET inspectors.[5] The "shoot out" involved four European divisions and was hosted by the 1st Armored Division. Wheel and track vehicles selected for inspection contained deliberate faults in order to provide a greater challenge and range of fault detection parameters.

The results attained from each MET inspection team made it clear that there were no recognizable standards, common base of expertise, or understanding among inspection teams in Europe. Of the 74 faults identified by at least one team, 47 (63+%) were found by only one inspector. Only one fault was identified by all four teams. Shown in Table 1 is a sample of the variation in faults noted on a M113A1 Armored Personnel Carrier.[6]

TABLE 1

ARMORED PERSONNEL CARRIER, M113A1

Total Items Noted (Not Operationally Ready)	Items Noted (By Inspectors) 1st AD	3D AD	3D ID	8TH ID
1. Control differential oil line quick release leaking	X		X	
2. Transmission oil line leaking	X			
3. Radiator overflow drain cock leaking	X		X	
4. Transmission oil sending unit hookup wire missing	X	X	X	
5. Left pivot steer not working	X			X
6. Heater fuel line leaking	X		X	
7. The cupola drag brake seized	X			
8. Fuel return line quick disconnect leaking fuel	X			
9. Rear injector pump fittings	X			
10. Fixed fire extinguisher seal broken	X	X	X	
11. Transmission oil light bulb missing	X			X
12. Differential oil light bulb burned out	X			X
13. Ramp lock inoperative	X			
14. Cooling system leaking at thermo housing		X	X	
15. Exhaust bell coupling not properly aligned			X	X
16. Front bilge pump inoperative			X	
17. Fan tower oil below add mark			X	
18. Secondary fuel filter drain cock leaking			X	

Recognizing that the "shoot out" lacked the rigor of a more formalized study, the problems identified clearly suggest the possibility that replacement of unwarranted parts and the tightening/adjusting of connections which may, in fact, be serviceable is widespread. Also implicit is the need for uniformity among inspector technical qualifications and more clearly defined inspection criteria which are geared to combat serviceable standards.

As previously discussed there is little doctrinal literature to guide TOE maintenance units in the performance of diagnostic and quality control functions. Standards are likewise left largely to individual interpretation. There is, however, an Army philosophy on quality management which is best described in the following statements.

> Product quality is largely dependent upon the skill and attitude of the repairman, the effectiveness of the soldier supervisor, and the degree of compliance with processing and procedural instructions. Quality can not be inspected into an item: it must be built-in by the individual repairman during shop processing. The quality of work performed is the responsibility of the repairman and supervisory personnel. Quality is directly influenced by the skill and attitude of maintenance personnel performing the work. It is inherent in the work process that every repairman check his work to determine that quality requirements are met.[7]

The philosophy cited above indicates that quality management is not a substitute for conscientiously performed work; effective accomplishment of a unit's maintenance mission is almost totally dependent upon the skills and attitudes of individual repairmen and their supervisors. Skill is a product of training; attitude is a product of motivation. Both are a command responsibility. Thus, if all repairman were skilled and motivated and all supervisors incapable of mistakes in judgement, the need for a quality control program would be obviated. In fact, all repairmen are not skilled and many are unable to determine an acceptable level of quality.

Not all supervisors can control the span of work for which they are responsible without occasionally approving a product of low quality. In short, it is generally recognized that a requirement for quality control procedures exists in a majority of TOE maintenance organizations and commanders must take steps within their limited resources to establish a program which meets their immediate needs.

STANDARDIZATION OF INSPECTION METHODS

The key figure in most quality control programs is the technical inspector. He may be designated to preclude the release of defective workmenship, to overcome an organizational deficiency (no provision for QC) or to reduce the unnecessary replacement of still serviceable components. Thus, the diagnostic ability of an inspector is paramount to a successful quality control program and provides the best cure for the common temptation among most repairmen--starting with remedies instead of diagnosis.

Within Army divisions there are basically two elements that are charged with the mission of inspecting equipment and evaluating the adequacy of general equipment maintenance: the Inspector General and the Maintenance Battalion. If the division and its subordinate commands are to benefit from these inspections, the inspectors must be in harmony. Inspectors must:

a. Set the example in professionalism. He must follow Army doctrine on methods of evaluating equipment (use technical manuals, TMDE, etc.) and post the results of his inspection in terms of published standards.

b. Be predictable. The individual or unit receiving an inspection must know in detail how it will be conducted and what standards will be used.

c. Be verifiable. The results of an inspection must be written so an operator or repairman can find the published standard against which the item was measured, duplicate the conditions (be able to identify what test equipment was used and how the equipment was operated) and achieve a similar observation or result.

d. Be limited to actions/conditions that are clearly the responsibility of the organization that has equipment undergoing an inspection.

To gain the greatest benefit from a standardization of inspection methods two policy guidelines should be published by the major commander: acceptance criteria for equipment being submitted to DS maintenance for repair and implementing inspection standards. The key elements of a DSU acceptance criteria are outlined below:

a. Unless precluded by the operational situation, all authorized maintenance within the capability of an organization will be accomplished before equipment is evacuated to a higher category of maintenance. Specifically, direct support will reject maintenance requests for the following circumstances:

1. Existence of a safety deficiency.

2. Existence of a deficiency which is within the scope and correction authority of organizational maintenance. Rejection shall be precluded by the owning unit demonstrating that a supply document number exists for parts not available, or verification by DS that the organizational deficiency will be corrected in the process of the DS repair.

3. Existence of a deficiency that will preclude DS fault diagnosis, DS repair or testing of equipment.

Equally important is a set of guidelines which can be applied by an inspector during the course of his diagnosis of repairs to be performed and his verification that work has been properly accomplished. Following are

eleven rules, or Criterion Referenced Maintenance Standards, designed for use by inspectors on a variety of equipment items:

CRITERION REFERENCED MAINTENANCE STANDARDS

1. Deficiencies will be defined in terms of a measurable deviation from a published standard.

2. Equipment will be inspected only at normal operating temperatures.

3. MET, IG, and DSU acceptance standards will be limited to those specified in PMCS, 20 level TMs and publications applicable to organizational level maintenance.

4. TMDE will be used wherever appropriate for inspecting equipment.

5. Exhaust systems will not be blocked to generate artificially high back pressure when inspecting for leaks. Black smudges are only symptoms and must be confirmed by sight, feel, etc.

6. Symptoms of deficiencies will be rejected unless the deficiency can be demonstrated, e.g. movement of a crossmember must be shown rather than presence of bare metal or rust on adjacent areas of the frame.

7. Electrical systems will be checked for shorts using TMDE. Connections, insulation, etc., will be considered adequate unless an existing short is suspected and/or demonstrated with test equipment.

8. Wherever a fluid leak is suspected the area will be thoroughly cleaned and the system operated a reasonable amount of time. Unless fresh evidence of leakage at an unacceptable rate is noted the old evidence will be ignored.

9. Contamination of fluids is a symptom of a problem and will not be assessed as a deficiency unless specifically cited as a "not ready" or "not mission capable" condition in the applicable TM. The condition

causing the contamination will be evaluated IAW the TM using appropriate TMDE.

10. Only current publications will be used for reference.

11. Items will not be assessed a deficiency for an unsafe condition unless the condition causes the items to be rated "not ready" or "not mission capable" in the applicable TM.

Opponents of the policies proposed above usually cite two reasons. First, it takes too long to properly inspect equipment with TMs and TMDE. Second, published standards are inadequate in some cases, especially when compared to the supposed experience and knowledge of the inspector. The reply to the first is obviously that it costs too much to not do it right. The cost is not only in the unneeded repairs but also in the bad example rendered. In maintenance training there is a constant theme of "know, don't guess; use your test equipment." That advice takes on a hollow ring when the inspector, who should be the example, uses only calibrated eyeballs and vague standards such as loose, worn, etc. The reply to the second is that failure to use the published standards because they are inadequate condones useless standards. A true professional knows how to change published standards and does so whenever needed. Systems should be made to work or they must be changed.

To eliminate gross inconsistencies between inspectors does not require a new creation but rather the systematic enforcement of existing doctrine and publications. The mystique of the inscrutable inspector must be changed; the burden of proof should rest squarely upon him to prove that his methods and standards are approved and appropriate. His findings must be specific and reflect an unacceptable deviation from the standard. In sum, well disciplined, criterion referenced inspection standards should be applied

wherever existing standards are quantifiable, measurable or performance oriented. Where standards are vague or imprecise, they should be highlighted to the responsible agency for upgrade to measurable criterion referenced standards.

DOCTRINAL CONSIDERATIONS

Effective application of the tools of quality management will assist the maintenance manager in attaining his operational and mission goals. The proper use of these tools will ensure that quality is not sacrificed for quantity.[8]

Quality management as it applies to the conduct of operations in the Direct Support Maintenance Battalion includes all activities that influence the production of usable, reliable, and durable products. Actions must be directed toward the detection of defects through well established diagnostic procedures, the prevention of defective work practices and the verification that work performed is in compliance with established requirements. The quality of work must be controlled whether performed in maintenance shops or on site by contact teams or maintenance support teams.

Unlike General Support (GS) maintenance activities where production lines, extensive equipment and facilities and the performance of complex repetitive operations dictate more comprehensive sampling and statistical quality control methods, such is not the case at DS level. Therefore, the term quality management becomes more generic at DS. Emphasis on fault diagnosis, by technical inspectors, the conduct of proper repair procedures and verification that standards have been met before a job is considered complete, form the foundation of any quality program, regardless of the name assigned by the unit, e.g. Technical Inspection and Quality Control, Quality Control, Quality Assurance, etc.

Quality management is a command responsibility. Maintenance battalion commanders must establish an overall policy for conducting the quality management program within their unit. The battalion Materiel Officer should be tasked to develop appropriate methods and procedures, publish SOPs and monitor the operation of the battalion's shops for compliance with stated policies. Maintenance company commanders, repair control supervisors and repair inspectors each have an important role in the conduct of the battalion's overall quality program.

Because doctrinal guidance is limited, the maintenance battalion commander has a great deal of flexibility in the structure of his program to control quality. One objective should remain clear: quality management functions must be independent of the repair element whenever possible, and personnel performing quality functions must not be subject to undue influence by supervisors.[9] Simply stated, commanders must become the honest broker between their production and their quality elements. Otherwise, production will almost certainly take priority over quality if this responsibility is vested in a single manager. Industry has long recognized the need to separate production and quality, but such has not been the case in most maintenance battalions. Unfortunately, TOE force structures often contribute to the dilemma by placing inspectors in the maintenance control section or, more commonly, not even authorizing an inspector in many commodity areas which then necessitates having a senior repairman verify the quality of work produced by his own section or perhaps approve his own work.

The alternative to current organizational shortcomings is the addition of dedicated inspectors to perform inspections in critical commodity areas. These inspectors would comprise an identifiable quality control element with its control line running to the unit headquarters. The advantages to

accrue from such a change are obvious, but the already restricted combat service support force structure leaves little hope that sufficient spaces will be generated in the foreseeable future. Besides, neither the personnel system nor the training base are currently prepared to deal with this option.

Given force structure restraints the maintenance battalion commander must be more pragmatic in his approach to establishing a quality control element. Once his program is developed and published, the major concern becomes day to day conduct plus an assurance that quality management goals are being met. Technical inspectors can be appointed to represent the various commodity areas. They may be noncommissioned officers or specialists depending upon their MOS, but each appointment should be personally approved by the commander. Most important, the battalion's warrant officers should become quality managers with the various inspectors falling under their direct supervision, according to specialty, e.g. automotive, armament, communications, electronic, engineer. The warrant officers in turn should report directly to the company commander instead of the maintenance control officer.

The designation of warrant officers as quality managers offers the following advantages:

1. The individual with the greatest technical expertise is assigned the overall responsibility for initial fault diagnosis, the most difficult task, and verification that repairs have been properly performed.

2. Separation of production and quality elements is realized.

3. All commodity elements can be monitored through warrant officers thus reducing the company commander's span of control over quality management.

4. Warrant officers are better able to train inspectors and resist undue influence for production output from the maintenance control section.

5. Warrant officers lend creditability to the quality function and provide a positive command representative during technical assistance visits and normal mission support situations.

6. Being charged with quality control causes the warrant officer to become more involved in the total repair cycle. He can still be a trainer of repairmen, but now his influence is felt in more than one phase of repair.

7. Being a quality manager is better utilization of a warrant officer's technical expertise than allowing him to perform other additional duties, such as platoon leader, which should be reserved for lieutenants.

8. In those cases involving low density equipment where a repairman must function as an inspector and a producer the warrant officer performs a quality assurance role.

9. No additional personnel assets are required and impact upon production capacity is minimized. In fact, production can even increase as a direct result of more accurate initial fault diagnosis and parts determination.

TRAINING

If a quality control program is to be effective, inspectors and supervisory personnel must be properly trained technically and must be able to adequately plan, implement, and supervise the program. They must have a clear understanding of the major areas of technical inspection, diagnostics, quality control planning and quality assurance. In short, the Army's maintenance inspectors and quality managers must be as well equipped in quality control as they are in production control. Commissioned and warrant officers also require continued review to assure that sufficient management training is included in their courses.[10]

While there is general agreement from all sources that quality control is a critical feature of maintenance management, virtually every recent evaluation of the maintenance soldier's ability to inspect and diagnose faults reflects a serious weakness. The practice of repair by replacement together with poor quality of repair has been documented in Army studies since at least 1967.[11] A major finding in a 1974 Battlefield Cannibalization Study reflected that DS maintenance personnel were deficient in the performance of technical inspections, parts determination, use of diagnostic equipment and technical manuals.[12] Again in January 1983 a Combat Service Support Mission Area Analysis produced by the US Army Ordnance Center and School points out a continuing insufficient capability within maintenance units to properly inspect and isolate faults on unserviceable equipment.[13] This continuing training deficiency is expensive in terms of money spent for unneeded repair parts, wasted manpower and reduced combat readiness.

A review of current programs of instruction for general equipment repairman provides but one example of the recurring training shortfall in the area of quality management. Although the terms inspect and diagnose are liberally used in task descriptions, the overwhelming perception remains one of teaching the repair process rather than fault isolation, use of TMDE and identification of a measurable deviation from a published standard. Teaching a soldier to perform a repair is important but teaching him a systematic approach to isolate faults is even more important. There is ample evidence that our training base is now and has for many years done less than a satisfactory job of the latter. Evidence also suggests that our schools can not prepare every repairman to be an inspector or quality manager. Ability to accomplish a repair must be a given for the qualified inspector. More importantly, he must know how to use TMDE, publications,

special tools and fault isolation techniques to identify what must be repaired and the parts required to complete the job.

A workable solution would entail the development of a follow-on track for selected NCOs in key technical courses which would focus on quality management. Satisfactory completion should entitle the graduate to a Additional Skill Identifier (ASI) as a quality control manager. Soldiers with a quality control ASI would then form a nucleus for field commanders to develop a quality management element within their organization. MOS courses now being taught to aviation inspectors plus a detailed analysis of reported soldier diagnostic weaknesses from various Army agencies should serve as a point of departure in the course development process.

The TRADOC service schools should also upgrade and expand selected officer, warrant officer and senior NCO courses programs of instruction in the area of quality management. Doctrine, how quality programs are designed and implemented, types of inspections, diagnostic procedures, determination of standards, use of TMDE and quality assurance techniques are minimum essential subjects. Until quality management is approached with the same degree of commitment as production management it is unlikely the Army can avoid further critical reports regarding our maintenance units' lack of proficiency in fault isolation and diagnosis of repair problems.

Within a maintenance battalion there is much that can be done even now to establish an effective quality management program. An in-house training program can be developed by the Materiel Officer and his staff which leads to the battalion's certification that certain inspectors are sufficiently qualified to function as quality control representatives. The program should start with warrant officers and senior technical inspectors and eventually include contact team chiefs who may have to function as supervisors and inspectors in remote or field locations. Upon completion of the

certification each inspector can be awarded a distinctive QC stamp which indentifies him by number as one of the commanders quality control specialists. In the communication electronics or fuel and electric component repair, where volume production is involved, a distinctive marking can also be assigned to each repairmen who then identifies his finished product. In this way inspectors and supervisors can readily isolate both good and bad workmanship. Additionally, the unit can develop a warranty program whereby alleged faulty workmanship can be traced to the source and appropriate action taken. Such a system tends to build pride of workmanship in the maintenance repairman and product confidence on the part of customer units. A side benefit is often derived when certain units continue to report serviceable items as faulty. In this case a technical assistance visit may be in order to discuss troubleshooting techniques utililized in those units.

A typical inspector certification program might be conducted in three phases.

Phase I--administrative training oriented on basic publications such as maintenance control system, DA PAM 310 series, TM 38-750, AR 710-2, SF 368 (quality defect report), equipment classification forms, equipment turn-in procedures, and any local regulations pertaining to QC.

Phase II--performance oriented training focused on each type equipment being supported, use of TMDE and special tools, driver training, technical assistance, elements of a quality management program.

Phase III--written and practical exercise. Satisfactory completion of an examination approved by the Materiel Officer along with satisfactory job performance for a specified period shall be required prior to certification.

TMDE AND SPECIAL TOOLS

Any discussion of the various maintenance quality control functions would be incomplete without addressing TMDE and special tools. If fault isolation and diagnosis is to take place there is a heavy dependence upon both categories of equipment.

In addition to existing training shortfalls in the proper use of TMDE, there are more serious weaknesses which effect quality control functions. With the ever evolving technology and changing designs in Army equipment the requirement to perform go--no go functional tests is becoming commonplace. Many modules and components require even more sophisticated test equipment for fault isolation and repair. Increased TMDE requirements are felt most in the communications electronic, fire control, missile and other general equipment where electronic components are replacing mechanical components. Complicating the issue at the maintenance battalion level is the proliferation of test equipment with each fielding of a new system. Moreover, there appears to be little concern at the developmental level to assemble a family of TMDE that may work on a variety of systems. At DS level the result is often a box or van load of test equipment for each new system which is virtually impossible to mobilize with current force structure limitations. If the unit commander is able to integrate all or part of the test equipment into his maintenance program he will most likely find that provisioning is too sparce to allow him to cover all dispersed supported units, let alone provide separate equipment for the quality control and the production elements.

In the example cited above it becomes apparent that the TMDE and special tool development must come under a more centralized direction at Army level. To field system unique test equipment compounds training

requirements, expands mobility requirements, and actually complicates and counters the commanders quality control efforts, because fault isolation now becomes more complex than ever. We need simplified test equipment which is highly mobile, versatile, easily taught and in sufficient quantity that both quality and production elements have access to it. Until drastic improvements are brought about at Army level in test equipment design, development and fielding the maintenance battalion commander faces a continuing challenge in quality management. In the face of these difficulties a sound in-house QC training and inspector certification program coupled with the appointment of warrant officer QC managers takes on added significance.

THE FUTURE

As the Army looks to the future, demands upon our combat service support community can be expected to grow at an alarming rate. Force modernization with some 400 systems being fielded or replaced; the Air Land Battle Doctrine with its emphasis on mobility and deep strikes; the explosion in printed circuit, electronic and other high technology equipment; and the inability of our active component logistics force structure to keep pace are but a few of the challenges facing the DS maintenance battalion. If the Army adopts a concept of three instead of four categories of maintenance[14] the forward support maintenance battalion will be under continuing pressure to repair a wide range of equipment as fast as possible, as far forward as possible and with as few supplies as possible. He must be prepared to manage battle damage assessment teams, conduct battlefield cannibalization, plus a myriad of other tasks. The ability to conduct a prompt and accurate diagnosis of faults to be repaired and the assurance that equipment is mission capable prior to returning it to customer units is implicit in the mission statement.

Without a sound technical inspection, fault diagnosis and quality management program in the forward support maintenance battalion, combat readiness will be seriously impaired. And without increased emphasis by DA and TRADOC on the training and staffing of quality management elements in our TOE maintenance units, the Army is destined to receive continued criticism on the ability of maintenance units to conduct systematic, and efficient fault diagnosis and equipment repair.

CONCLUSIONS

- The complexity and high cost of today's equipment dictates more than ever that the Army maintenance system employ effective fault isolation and verifiable repair procedures.
- Quality control systems are not given equal priority or attention among the various commodity areas. If this were true general equipment found in most TOE units would undergo QC programs similar to aircraft, missile and ammunition.
- Maintenance standards are often vague, nonquantifiable and difficult to interpret. As a result various maintenance inspectors develop their own version of what should and should not be which ultimately leads to needless repairs, conflicting materiel readiness reporting, and frustrated commanders and equipment operators.
- Quality management doctrine is limited in scope and offers little tangible guidance to a DS maintenance battalion in the form of sample QC policies, programs or procedures.
- Army philosophy that quality must be built-in and cannot be inspected in is valid. Unfortunately, the training base appears to have adopted this as a basis for avoiding a

quality control course since all repairmen are seemingly taught to do their own fault isolation and verification of satisfactory repairs. Yet the inability of repairmen to diagnose faults, use TMDE and technical publications, or identify parts requirements is a finding in virtually every study concerning maintenance operations.

- Quality management is not treated as an equal to production management in terms of training provided, force structure authorizations or personnel and MOS systems. If this were true every area of maintenance would have authorized QC spaces and there would be trained specialists with an identifiable MOS.
- Maintenance battalion commanders must make better use of their greatest source of technical expertise, the warrant officer, if they hope to overcome the many existing system failures in quality management. Repairmen and first line supervisors are simply not prepared to function as production and quality control specialists.
- An in-house training and inspector certification program provides the best short term approach to development of a workable QC program at the DS level.
- Quality management training to selected NCOs as an add on track to their EPMS courses and award of an ASI would be a valuable first step in the development of a core of quality control specialists. Warrant and officer courses also suffer from a lack of quality management training.

- Once QC systems are in place within the maintenance battalion, warranty programs and individual repairman recognition can offer improved product quality and customer confidence.
- TMDE and special tool design, development and fielding is not well coordinated at Army level. This results in hardships in the field and a detraction from unit level QC programs due to the complexity and unreliability of some current TMDE items.

RECOMMENDATIONS

- Army technical publications should be developed to clearly announce maintenance standards in terms that are measurable, identifiable and based on combat serviceable criteria. Application of the criterion referenced approach to technical inspections should be stressed during the development, training and employment of maintenance standards.
- The TRADOC training base, in concert with the military personnel and force structure experts, should implement a more effective program to identify and train selected quality control specialists with a view toward award of an MOS additional skill identifier. The insistence in the past that all repairmen can be sufficiently trained to offset the need for a quality management element at DS is faulty logic.
- Quality management doctrine and training programs must be upgraded until their emphasis equals that which is placed upon production management. This evolution should begin in the professional development courses now being taught by TRADOC service schools.

- Maintenance battalion commanders should take a hard look at their current program to manage quality. Chances are that improvements are needed, and many can be satisfied by intensive in-house training and certification programs plus greater reliance upon their warrant officers as a source of technical expertise for maintenance training and quality management.
- The design, development, intended application, provisioning and fielding of TMDE and special tools must be brought under greater control at Army level. Highly mobile, reliable, versatile, and simplified TMDE and special tools are vital to current and future quality management programs as well as the assurance that Army equipment is maintained to optimum conditions in support of combat readiness goals.

ENDNOTES

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3. TI/QC Study, pp. 2-5.

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5. Faith, John C., MG, First Armored Division, Letter to Commander, VII US Corps, Subject: After Action Report: Maintenance Evaluation Team (MET) Inspection meeting. APO New York 09326: 13 March 1980.

6. Ibid.

7. US Department of the Army, Army Pamphlet 750-19, Quality Management for Direct Support/General Support Maintenance Operations. Washington: 31 October 1973. pp. 1-2.

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9. Ibid.

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14. Office of the Deputy Chief of Staff for Logistics (ODCSLOG), Maintenance--Start (State of the Total Army Report Team), Washington: 21 September 1982.

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