Department of the Army
Pamphlet 750–40

Maintenance of Supplies and Equipment

Guide to Reliability Centered Maintenance (RCM) for Fielded Equipment

Headquarters
Department of the Army
Washington, DC
15 May 1982

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SUMMARY of CHANGE

DA PAM 750–40
Guide to Reliability Centered Maintenance (RCM) for Fielded Equipment

This change 1-

o Replaces various paragraphs from chapter 1, 1-3 and 1-4.

o Replaces various paragraphs from chapter 2, 2-1 thru 2-3.

o Replaces various paragraphs from chapter 3, 3-4.

o The glossary section has new entries

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Maintenance of Supplies and Equipment

Guide to Reliability Centered Maintenance (RCM) for Fielded Equipment

By Order of the Secretary of the Army:

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Summary. This pamphlet is intended for use by all Army commands having responsibility for materiel development and management. The guidance presented in this pamphlet illustrates how the elements of Reliability Centered Maintenance (RCM) are planned, developed, and incorporated into maintenance plans/programs for materiel systems. Individual materiel developers are expected to tailor the techniques to fit their particular item/system needs.

Applicability. Not applicable.

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Contents (Listed by paragraph and page number)

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Chapter 1
Reliability Centered Maintenance

1–1. Purpose.

This pamphlet is intended for use by all Army commands having responsibility for materiel development and management. The guidance presented in this pamphlet illustrates how the elements of Reliability Centered Maintenance (RCM) are planned, developed, and incorporated into maintenance plans/programs for materiel systems. Individual materiel developers are expected to tailor the techniques to fit their particular item/system needs.

1–2. Introduction

Maintenance planning has been recognized as one of the interrelated elements of logistic support for a number of years. As such, it is one of the support criteria that is normally integrated into the system/equipment design at an early stage. As more efficient maintenance concepts are developed, they are injected into newly developing systems/equipment. This leaves fielded systems/equipment in service, with maintenance being performed in less efficient ways than have evolved through recent developments. In addition, as money for defense spending becomes tighter, these inefficient maintenance concepts consume a disproportionate share of the maintenance dollar. With this in mind, the present maintenance concept for fielded systems/equipment requires modification to provide a more efficient maintenance program. The revised maintenance program will be developed using the concepts and principles of Reliability Centered Maintenance (RCM).

1–3. Background

a. The Reliability and Maintainability Subcommittee of the Air Transport Association published a Maintenance Steering Group document, "Airline Manufacturer's Maintenance Program and Planning Document" (MSG–2), which described the maintenance concept for new aircraft. This concept was so successful in its initial application that the airlines used it to revise maintenance programs for older aircraft. The Navy tailored the concept and successfully applied it to the P–3 Aircraft under the name of Analytical Maintenance Program (AMP) and is currently adopting the MSG–2 concept for other aircraft.

b. Through the issuance of Program Objective Memorandum (POM) 78–82, the Army established the requirement that the MSG–2 concept, under the title Reliability Centered Maintenance (RCM), be applied to all Army weapon systems/equipment by the end of fiscal year 79.

c. RCM is based on the premise that maintenance cannot improve upon the safety or reliability inherent in the design of the hardware. Good maintenance can only preserve those characteristics. The RCM concept uses decision logic to evaluate and construct maintenance tasks which are based on the equipment functions and failure modes.

d. The RCM program consists of three categories of maintenance, hard–time, on–condition, and condition monitoring, which are defined as follows:

(1) Hard–time limit. Scheduled maintenance tasks that are performed at a predetermined, fixed interval because of age or usage such as operating time, flying hours, miles driven or rounds fired.

EXAMPLES:

(a) Overhaul of aircraft engines after a fixed number of flying hours.
(b) Replacement of gun tubes after firing of a fixed number of equivalent full charge rounds.
(c) Oil changes at a fixed calendar and/or mileage interval.

(2) On–condition. Maintenance is performed or item is replaced based upon the condition of the item as determined by an evaluation of each item performed on a scheduled basis. On–condition evaluations are a maintenance burden. They expend maintenance resources when performed by maintenance personnel such as quarterly or semi–annual organizational maintenance services. When imposed as an operator/crew requirement, the inspection subtracts from the time available for actual operation. On–condition evaluations and inspections are performed for either of two reasons:

(a) To anticipate failure by detection of deterioration and thereby attempt to prevent the occurrence of failure during operation.

EXAMPLES:

1. Check of radiator coolant level at appropriate interval.
2. Spectrometric analysis to measure wear metal content of tank engine oil.

(b) To determine the occurrence of hidden failures; i.e., failures that are not detectable by the operator/crew during normal operation.

EXAMPLES:

1. Monthly check of emergency lighting system which normally operates only in event of primary power failure.
2. Weekly radar collimation check.

(3) Condition Monitoring. Condition of equipment is monitored during normal operation or start up procedures without detracting from actual operation. The operator/crew is directed to monitor for specified abnormal conditions in the during operation column of a Preventive Maintenance Checks and Services (PMCS) table. The condition monitored item may normally be corrected by the operator/crew or be operated for the duration of the mission without any adverse effects. It is performed for either of two reasons:

(a) To observe a deteriorating condition which will lead to failure if uncorrected. To be fully effective, the onset of deterioration must be detected early enough to allow completion of the mission before failure occurs.

EXAMPLES:

1. Check battery–generator indicator gauge during operation.
2. Check for clutch slippage or chatter during operation.

(b) To observe the occurrence of failure during operation.

1–4. Objectives

a. The objective of this guide is to present procedures which will establish an effective maintenance program consisting of valid tasks by applying RCM logic developed specifically for fielded equipment.

b. The accomplishment of these objectives will preserve the inherent design levels of reliability and safety and accomplish it at the minimum practical cost. Only through engineering design changes can deficiencies in the inherent levels of reliability and safety be corrected; therefore, an effective maintenance program must be developed to prevent deterioration of these inherent levels of safety and reliability.

1–5. Scope

a. RCM logic will be used by all DARCOM subordinate commands and activities to determine a maintenance program for fielded equipment/systems. It is provided to assist in the revision of PMCS for fielded equipment/systems. The logic and approach are adapted to any fielded system, including those having limited documentation of a failure data and where extensive field experience is available to the command. In determining the maintenance program for specific equipment/systems, the logic provided in Figure 2–1 will be used unless approval to deviate is given by HQ DARCOM.

b. All proponent users of this guide are encouraged to further adopt the fielded system RCM program to the characteristics and design requirements of the commodity. Mission and/or safety requirements may dictate a need for a more detailed review such as a full scale engineering analysis. A product improvement program may change the design of the equipment such that previous field experience or maintenance concept does not apply; therefore, a more indepth analysis will be required.

Example:

A missile system undergoing modification from a product improvement program and because of the nature of the mechanical assemblies, a source for specific failure rate data was not available; therefore, in order to establish meaningful reliability predictions, every item was examined to determine if it was stressed during each particular operation and compared to other similar items for which data was available. In every case, the elements' operating environment was considered during the assignment of predicted failure rates. This type of analysis is an adaptation of a Failure Mode Effects and Criticality Analysis (FMECA) which was required to insure that the maintenance program retained/preserved the inherent design of the hardware. This is an adaptation of developmental analysis which is required and encouraged to insure that the best scheduled maintenance plan is developed.

c. The application of RCM logic to Technical Manuals will be reviewed by TRADOC in accordance with AR 310–3. The decision logic and Maintenance Process Analysis Work Sheets used to develop the maintenance program will be provided TRADOC along with the proposed Technical Manual.

Note. Appendix E of DARCOM Supplement 1 to AR 310–3 "Preparation, Coordination, and Approval of Department of the Army Publications" provides the applicable TRADOC agencies and/or user schools that are to review the Technical Manuals along with the number of copies required by each agency or user school.

Chapter 2
Application of RCM Logic

2–1. RCM Logic

a. The RCM logic presented in Figure 2–1 is designed to accomplish the following:

(1) Identify components in the system/equipment which are critical in terms of mission and/or safety.

(2) Provide a logical analysis process to determine the feasibility and desirability of scheduled maintenance task requirements.

(3) Provide supporting justification for scheduled maintenance task requirements.

b. The logic process is based upon the following criteria:

(1) Scheduled maintenance tasks should be performed on noncritical components only when performance of the task will be cost effective in terms Of maintenance and support resources.

(2) Scheduled maintenance tasks should be performed on critical components in order to prevent any decrease in realiability, safety, or mission performance.

c. Any scheduled tasks that were assumed in establishing the reliability characteristics of the system/equipment under the reliability program must either be included in the maintenance plan or identified as being omitted from the maintenance plan. Inherent failure rates and failure modes and effects may change if an assumed scheduled maintenance action is omitted from the maintenance plan after application of the RCM logic.

d. When determining if a component is critical for mission considerations, the primary assigned mission of an individual piece of equipment will be the governing factor. Thus, for a missile component, the individual missile is addressed, not the complete missile system composed of multiple launchers and missiles. Another example would be a Truck Cargo 2 1/2–Ton, M35A2. The primary mission of the one vehicle is the governing factor, not the mission of a fleet.

e. A function is considered redundant when a backup system (component) can be used to complete the mission.

<u>Example:</u>

(1) An aircraft has a backup power supply designed to take over upon failure of the primary.

(2) A tank turret is operated using a hydraulic–electric system with a backup (redundant) system that is manual.

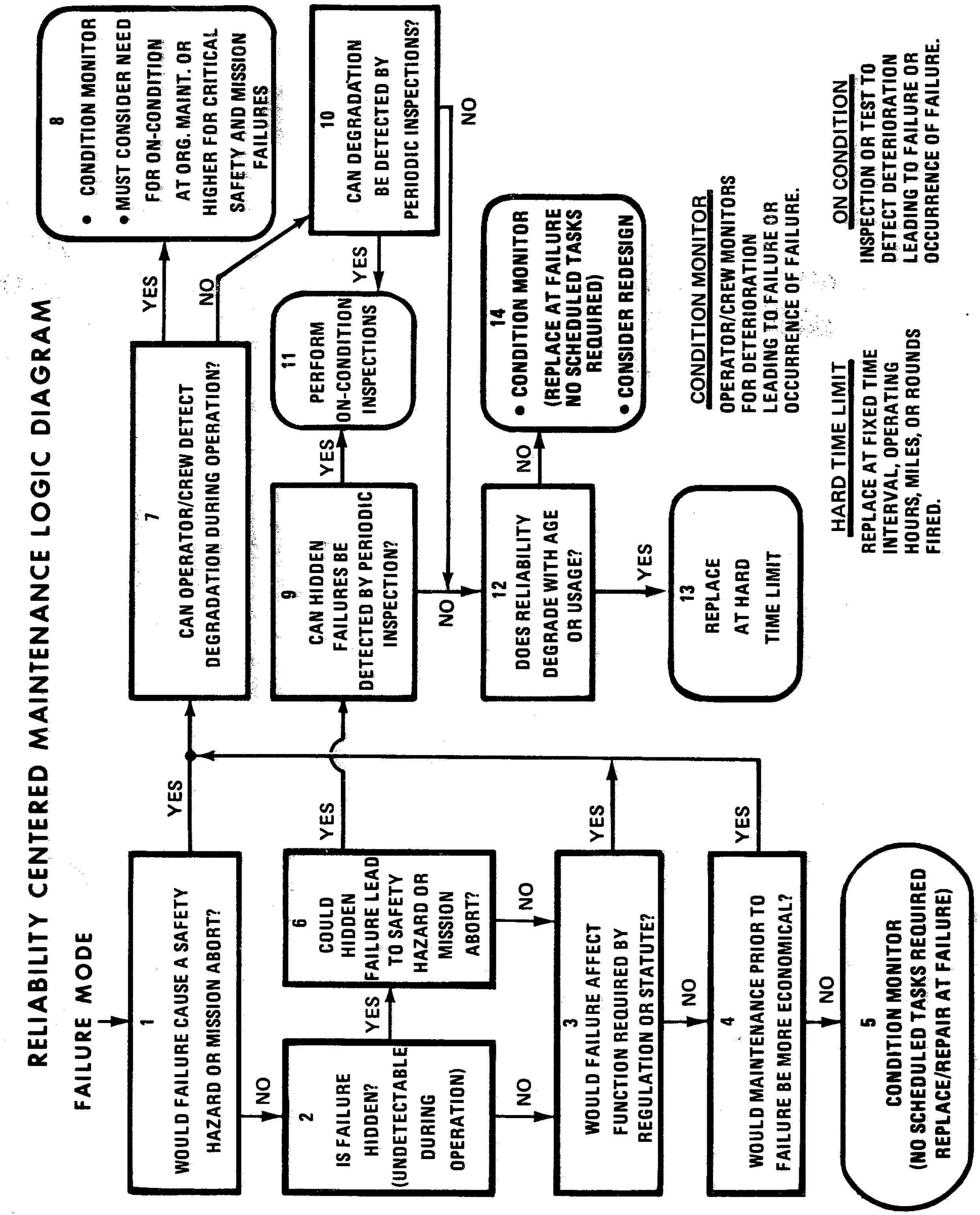

Figure 2–1. Reliability Centered Maintenance Logic Diagram

2–2. Input Data

a. The input data includes complete analysis of the present Maintenance Program and the compilation of the input data necessary to the application of the decision logic in the development of an RCM program.

b. The development of an RCM Program for existing military systems/equipment requires a large number of logic decisions pertaining to:

(1) Which individual requirements are necessary,

(2) Scope and frequency in which requirements should be performed, and

(3) Impact on maintenance and support.

c. The major input to decision logic will be the PMCS requirements for a fielded system augmented by any known data on problem areas not yet incorporated in the publications. A Failure Mode Effects and Criticality Analysis (FMECA), if prepared under the development contract for the item, should also be used. Each failure mode for which an inspection exists or is being considered is subjected to the questions in Figure 2–1 and answers recorded on PA Form 4838–R, Maintenance Process Analysis Worksheet (Figure 2–2). Up to four failure modes may be entered. The worksheet is used to record the data necessary to evaluate the impact of each failure and to arrive at a maintenance program. DA Form 4838–R will be reproduced locally on 8 ½″ x 13″ paper.

d. The blocks on the sample Maintenance Process Analysis Work Sheet are to be filled out as follows:

Block

1. Major Item – enter name of major item.
2. Prepared By – enter name of preparer.
3. Preparing Organization – enter name of organization preparing work sheet.
4. Nomenclature – enter name of item being evaluated.
5. Part Number – enter part number of the item being evaluated.
6. Date – enter date when work sheet was prepared.
7. Revision Number – enter the revision number after initial preparation.
8. Failure Mode – enter the failure mode under consideration. Up to four failure modes may be listed. The failure mode should describe the condition after failure (e.g., no output, binding, power loss, pressure loss).
9. Classification – for each failure mode, classify each as to effects on safety and mission with one of the following: catastrophic, critical, marginal, or minor.

10–37 Information Summary – enter additional information that would aid in the evaluation, such as inspection intervals, special tools, test equipment, and level of repair, etc.

MAINTENANCE PROCESS ANALYSIS WORKSHEET

For use of this form, see DA PAM 750-40; the proponent agency is DARCOM.

1. MAJOR ITEM	2. PREPARED BY			
3. PREPARING ORGANIZATION	4. NOMENCLATURE			
5. PART NUMBER	6. DATE		7. REVISION NO.	
8. FAILURE MODE(S)	A	B	C	D
9. CLASSIFICATION	A	B	C	D

NO.	LOGIC QUESTION		YES	NO	INFORMATION SUMMARY
1	WOULD FAILURE CAUSE A SAFETY HAZARD OR MISSION ABORT?	A			10.
		B			
		C			
		D			
2	IS FAILURE HIDDEN?	A			11.
		B			
		C			
		D			
3	WOULD FAILURE AFFECT FUNCTION REQUIRED BY REGULATION OR STATUTE?	A			12.
		B			
		C			
		D			
4	WOULD MAINTENANCE PRIOR TO FAILURE BE MORE ECONOMICAL?	A			13.
		B			
		C			
		D			
5	CONDITION MONITOR	A			14.
		B			
		C			
		D			
6	COULD HIDDEN FAILURE LEAD TO SAFETY HAZARD OR MISSION ABORT?	A			15.
		B			
		C			
		D			
7	CAN OPERATOR/CREW DETECT DEGRADATION DURING OPERATION?	A			16.
		B			
		C			
		D			
8	CONDITION MONITOR	A			17.
		B			
		C			
		D			
9	CAN HIDDEN FAILURES BE DETECTED BY PERIODIC INSPECTION?	A			18.
		B			
		C			
		D			
10	CAN DEGRADATION BE DETECTED BY PERIODIC INSPECTIONS?	A			19.
		B			
		C			
		D			
11	ON-CONDITION	A			20.
		B			
		C			
		D			
12	DOES RELIABILITY DEGRADE WITH AGE OR USAGE?	A			21.
		B			
		C			
		D			
13	HARD TIME	A			22.
		B			
		C			
		D			
14	CONDITION MONITOR	A			23.
		B			
		C			
		D			

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Figure 2–2. Maintenance Process Analysis Worksheet

2–3. Determination of Criticality and Maintenance Method

a. The decision logic consists of nine “trigger” questions. Five of these questions (1, 2, 3, 4, and 6) establish the criticality of the component under evaluation. An inspection or service is required to anticipate failure before someone is injured, the mission aborts, or costly damage occurs. An inspection may also be required to detect hidden failures which can affect safety, mission performance, or compliance with administrative or legal procedures. At this point, there are still options as to how each maintenance task can be effectively performed. The remaining four questions (7, 9, 10, and 12) lead the analyst to the proper maintenance category: condition monitoring, on–condition, hard–time, or some combination of the three.

b. Each question is discussed separately in the following paragraphs. The sample answers provided are offered only to clarify the process. “NO” answers for some equipment will be “YES” answers for others. Each weapon system must be thoroughly analyzed by knowledgeable technical personnel to determine the appropriate answers to the item under evaluation.

c. C. Block 1 – Would Failure Cause a Safety Hazard or Mission Abort?

(1) A YES answer to this question indicates that a failure of the component under consideration could result in the immediate suspension of the operation of the system/equipment for such a period of time that it could prevent the successful completion of the mission. It could also indicate that the occurrence of the failure could produce such results that injury of personnel or damage to equipment would be likely or possible. If the component under consideration has a redundant (backup) system, it may fail in the mode under consideration and the mission can be carried to a successful conclusion.

Note. The configuration of the backup system need not be identical to the primary, but it must provide capability to complete the mission. If this is the case, then this question should be answered NO.

(a) YES Failure can injure personnel. Check “YES” for the failure mode under consideration and continue with block 7.

EXAMPLES:

1. Loose antenna tie–down on vehicle mounted radio (fig 2–3).
2. Loss of hydraulic fluid in GOER Vehicle Steering System.
3. Loose connection of grounding strap on 3 KW Generator.

(b) YES Failure can abort the mission. Check “YES” on the work sheet for the failure mode and continue with block 7.

EXAMPLES:

1. Break in tank track linkage.
2. Loss of missile internal voltage source.
3. Loss of audio output from radio.

(2) A No answer would indicate that a failure of the component, while possibly affecting the efficiency of the operation, would not be sufficiently serious in nature to require curtailment of the mission, cause personnel injury, or damage equipment. Nor would it produce a chain reaction resulting in a critical failure.

(a) NO Failure will not injure personnel or abort the mission. Check “NO” for the failure mode and continue with block 2.

EXAMPLES:

1. Failure of reperforator–transmitter in a teletypewriter terminal (fig 2–4).
2. Failure of a single shock absorber in wheeled vehicle.
3. Failure of windshield wipers in military wheeled vehicle. (This may abort the mission in some tactical vehicles and require that the question be answered yes).
4. Failure of single aircraft alternator when redundant (backup) is cut in automatically.

MAINTENANCE PROCESS ANALYSIS WORKSHEET

For use of this form, see DA PAM 750-40; the proponent agency is DARCOM.

1. MAJOR ITEM: AN/VRC	2. PREPARED BY
3. PREPARING ORGANIZATION	4. NOMENCLATURE: Antenna Tie-Down

5. PART NUMBER	6. DATE	7. REVISION NO.

	A	B	C	D
8. FAILURE MODE(S)	Loose			
9. CLASSIFICATION	Critical			

NO.	LOGIC QUESTION		YES	NO	INFORMATION SUMMARY
1	WOULD FAILURE CAUSE A SAFETY HAZARD OR MISSION ABORT?	A	X		10. A safety hazard exists when antenna tie-
		B			down allows the antenna to spring loose.
		C			
		D			
2	IS FAILURE HIDDEN?	A			11.
		B			
		C			
		D			
3	WOULD FAILURE AFFECT FUNCTION REQUIRED BY REGULATION OR STATUTE?	A			12.
		B			
		C			
		D			
4	WOULD MAINTENANCE PRIOR TO FAILURE BE MORE ECONOMICAL?	A			13.
		B			
		C			
		D			
5	CONDITION MONITOR	A			14.
		B			
		C			
		D			
6	COULD HIDDEN FAILURE LEAD TO SAFETY HAZARD OR MISSION ABORT?	A			15.
		B			
		C			
		D			
7	CAN OPERATOR/CREW DETECT DEGRADATION DURING OPERATION?	A	X		16. Operator/crew can detect when tie-down
		B			becomes loose.
		C			
		D			
8	CONDITION MONITOR	A	X		17. Condition monitor during operation.
		B			Because of critical safety hazard, have
		C			a "before operation" (on condition)
		D			check.
9	CAN HIDDEN FAILURES BE DETECTED BY PERIODIC INSPECTION?	A			18.
		B			
		C			
		D			
10	CAN DEGRADATION BE DETECTED BY PERIODIC INSPECTIONS?	A			19.
		B			
		C			
		D			
11	ON-CONDITION	A			20.
		B			
		C			
		D			
12	DOES RELIABILITY DEGRADE WITH AGE OR USAGE?	A			21.
		B			
		C			
		D			
13	HARD TIME	A			22.
		B			
		C			
		D			
14	CONDITION MONITOR	A			23.
		B			
		C			
		D			

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Figure 2–3. Maintenance Process Analysis Worksheet Example

MAINTENANCE PROCESS ANALYSIS WORKSHEET

For use of this form, see DA PAM 750-40; the proponent agency is DARCOM.

1. MAJOR ITEM	2. PREPARED BY
3. PREPARING ORGANIZATION	4. NOMENCLATURE Reperforator-Transmitter
5. PART NUMBER	6. DATE / 7. REVISION NO.

	A	B	C	D
8. FAILURE MODE(S)	Jammed			
9. CLASSIFICATION	Marginal			

NO.	LOGIC QUESTION		YES	NO	INFORMATION SUMMARY
1	WOULD FAILURE CAUSE A SAFETY HAZARD OR MISSION ABORT?	A		x	10. Mission is not aborted.
		B			
		C			
		D			
2	IS FAILURE HIDDEN?	A		x	11. Operator/crew knows when failure has
		B			occurred.
		C			
		D			
3	WOULD FAILURE AFFECT FUNCTION REQUIRED BY REGULATION OR STATUTE?	A		x	12. Statutes/regulations are not affected.
		B			
		C			
		D			
4	WOULD MAINTENANCE PRIOR TO FAILURE BE MORE ECONOMICAL?	A	x		13. A trade-off study has indicated that peri-
		B			odic cleaning and adjustment of the re-
		C			perforator-transmitter will prevent some
		D			failures and is more cost effective than
5	CONDITION MONITOR	A			14. operating to failure and replacing/re-
		B			pairing at that time.
		C			
		D			
6	COULD HIDDEN FAILURE LEAD TO SAFETY HAZARD OR MISSION ABORT?	A			15.
		B			
		C			
		D			
7	CAN OPERATOR/CREW DETECT DEGRADATION DURING OPERATION?	A		x	16. Operator/crew cannot detect degradation.
		B			
		C			
		D			
8	CONDITION MONITOR	A			17.
		B			
		C			
		D			
9	CAN HIDDEN FAILURES BE DETECTED BY PERIODIC INSPECTION?	A			18.
		B			
		C			
		D			
10	CAN DEGRADATION BE DETECTED BY PERIODIC INSPECTIONS?	A	x		19. Inspection can detect deterioration.
		B			
		C			
		D			
11	ON-CONDITION	A	x		20. Include a periodic inspection to detect
		B			equipment degradation which will lead to
		C			failure. Monthly basis operator check for
		D			excessive dust/dirt and clean as necessary.
12	DOES RELIABILITY DEGRADE WITH AGE OR USAGE?	A			21.
		B			
		C			
		D			
13	HARD TIME	A			22.
		B			
		C			
		D			
14	CONDITION MONITOR	A			23.
		B			
		C			
		D			

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Figure 2–4. Maintenance Process Analysis Worksheet Example

(b) NO Failure will temporarily delay or interrupt the mission, but operator/crew can correct quickly enough to avoid aborting the mission. Check "NO" and go to block 2.

EXAMPLES:

1. Failure of a fuse (fig 2–5).
2. Loose cable connector at battery terminal.
3. Flat tire.

d. Block 2 – IS Failure Hidden? (Undetectable During Operation.)

(1) A YES answer to this question indicates that a failure of the component would not be detectable by operator/crew.

(a) YES Failure in backup system is not apparent to operator/crew and the primary is still operating. Check "YES" and continue with block 6.

Example:

Failure of backup alternator is not indicated to operator.

(b) YES Failure of a protective function and the function to be protected has not failed. Check "YES" and continue with block 6.

Example:

Failure of an over–voltage or over–current protection circuit.

(c) YES Deterioration below operating level required for mission performance which is not apparent to operator/crew during normal operation. Check "YES" and continue with block 6.

Example:

Decrease in radar receiving sensitivity or output power resulting in not picking up a target (fig 2–6).

(2) A NO answer indicated that the failure is not hidden. Check "NO" on the work sheet and continue with block 3.

Example:

Failure of primary aircraft alternator is indicated to the operator.

MAINTENANCE PROCESS ANALYSIS WORKSHEET

For use of this form, see DA PAM 750-40; the proponent agency is DARCOM.

1. MAJOR ITEM	2. PREPARED BY			
3. PREPARING ORGANIZATION	4. NOMENCLATURE Fuse			
5. PART NUMBER	6. DATE		7. REVISION NO.	
8. FAILURE MODE(S)	A Open	B	C	D
9. CLASSIFICATION	A Marginal	B	C	D

NO.	LOGIC QUESTION		YES	NO	INFORMATION SUMMARY
1	WOULD FAILURE CAUSE A SAFETY HAZARD OR MISSION ABORT?	A		x	10. Mission is not aborted.
		B			
		C			
		D			
2	IS FAILURE HIDDEN?	A		x	11. Operator/crew knows when failure occurs.
		B			
		C			
		D			
3	WOULD FAILURE AFFECT FUNCTION REQUIRED BY REGULATION OR STATUTE?	A		x	12. Regulation/statute not affected.
		B			
		C			
		D			
4	WOULD MAINTENANCE PRIOR TO FAILURE BE MORE ECONOMICAL?	A		x	13. Degradation cannot be detected by opera-
		B			tor/crew or by inspection. Therefore, no
		C			maintenance prior to failure can be per-
		D			formed.
5	CONDITION MONITOR	A	x		14. No scheduled tasks are required. No
		B			"during operation" checks required.
		C			Operate to failure.
		D			
6	COULD HIDDEN FAILURE LEAD TO SAFETY HAZARD OR MISSION ABORT?	A			15.
		B			
		C			
		D			
7	CAN OPERATOR/CREW DETECT DEGRADATION DURING OPERATION?	A			16.
		B			
		C			
		D			
8	CONDITION MONITOR	A			17.
		B			
		C			
		D			
9	CAN HIDDEN FAILURES BE DETECTED BY PERIODIC INSPECTION?	A			18.
		B			
		C			
		D			
10	CAN DEGRADATION BE DETECTED BY PERIODIC INSPECTIONS?	A			19.
		B			
		C			
		D			
11	ON-CONDITION	A			20.
		B			
		C			
		D			
12	DOES RELIABILITY DEGRADE WITH AGE OR USAGE?	A			21.
		B			
		C			
		D			
13	HARD TIME	A			22.
		B			
		C			
		D			
14	CONDITION MONITOR	A			23.
		B			
		C			
		D			

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Figure 2–5. Maintenance Process Analysis Worksheet Example

MAINTENANCE PROCESS ANALYSIS WORKSHEET

For use of this form, see DA PAM 750-40; the proponent agency is DARCOM.

1. MAJOR ITEM	2. PREPARED BY
3. PREPARING ORGANIZATION	4. NOMENCLATURE IF Amplifier
5. PART NUMBER	6. DATE / 7. REVISION NO.

	A	B	C	D
8. FAILURE MODE(S)	Loss of Sensitivity			
9. CLASSIFICATION	Marginal			

NO.	LOGIC QUESTION		YES	NO	INFORMATION SUMMARY
1	WOULD FAILURE CAUSE A SAFETY HAZARD OR MISSION ABORT?	A		x	10. No mission abort.
		B			
		C			
		D			
2	IS FAILURE HIDDEN?	A	x		11. Failure is hidden from operator/crew.
		B			
		C			
		D			
3	WOULD FAILURE AFFECT FUNCTION REQUIRED BY REGULATION OR STATUTE?	A			12.
		B			
		C			
		D			
4	WOULD MAINTENANCE PRIOR TO FAILURE BE MORE ECONOMICAL?	A			13.
		B			
		C			
		D			
5	CONDITION MONITOR	A			14.
		B			
		C			
		D			
6	COULD HIDDEN FAILURE LEAD TO SAFETY HAZARD OR MISSION ABORT?	A	x		15. Continued decrease in sensitivity can
		B			lead to a non-operational condition.
		C			
		D			
7	CAN OPERATOR/CREW DETECT DEGRADATION DURING OPERATION?	A			16.
		B			
		C			
		D			
8	CONDITION MONITOR	A			17.
		B			
		C			
		D			
9	CAN HIDDEN FAILURES BE DETECTED BY PERIODIC INSPECTION?	A	x		18. Periodic inspection can detect the de-
		B			graded condition.
		C			
		D			
10	CAN DEGRADATION BE DETECTED BY PERIODIC INSPECTIONS?	A			19.
		B			
		C			
		D			
11	ON-CONDITION	A	x		20. Include a periodic inspection (quarterly)
		B			to detect equipment degradation by direct
		C			support.
		D			
12	DOES RELIABILITY DEGRADE WITH AGE OR USAGE?	A			21.
		B			
		C			
		D			
13	HARD TIME	A			22.
		B			
		C			
		D			
14	CONDITION MONITOR	A			23.
		B			
		C			
		D			

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Figure 2–6. Maintenance Process Analysis Worksheet Example

e. Block 3 – Would Failure Affect Function Required by Regulation or Statute?

(1) A YES answer indicates that there is a regulation or statute that requires this item to be operational. The component may not affect safety or mission but due to requirements this item must have some maintenance performed to insure that it is functioning properly.
YES Failure affects function required by Federal, Foreign, or local statutes and/or regulations. Check "YES" and continue with block 7.

<u>Examples:</u>

(a) Failure of a filter circuit designed to prevent radio frequency interference (fig 2–7).
(b) Failure of pollution control system on an administrative vehicle in a state requiring adherence to standards.
(c) Failure of turn signals that are required by a Foreign country.

(2) A NO answer indicates that a failure does not affect administrative or legal requirements. If so, check "NO" and continue with block 4.

f. Block 4 – Would Maintenance Prior to Failure be More Economical?

(1) YES Maintenance prior to failure is more economical. The failure of the component does not affect mission or safety and is not required by regulation. The answer to this question will be based on economics. The analyst must perform a trade–off study to determine the cost of performing maintenance before and after failure. Parameters to consider are mean time before failure, item density, tools and test equipment, down time for PM versus down time for repair, training, and the maintenance level required for repair versus the level required for PM. Other parameters should be included if they directly affect the cost. If it is found that maintenance prior to failure is the least costly, check "YES" and continue with block 7.

<u>Examples:</u>

(a) Failure of reperforator–transmitter in a teletypewriter terminal (fig 2–4).
(b) Spot painting to prevent corrosion.
(c) Clean breech mechanism to prevent corrosion.
(d) Wipe down hydraulic push rod with oil after operation.

(2) <u>NO</u> Would maintenance prior to failure be more economical. Check "NO" and enter condition monitor in information summary blocks. Proceed to block 5 and indicate any additional information such as level or repair, failure indicators or special tools and test equipment.

<u>Examples:</u>

(a) Failure of hinge pin in glove compartment.
(b) Failure of an operator/crew replaceable part (fuse, module, etc) for which a replacement (spare) is on–hand (stocked with the end item (fig 2–5).

MAINTENANCE PROCESS ANALYSIS WORKSHEET For use of this form, see DA PAM 750-40; the proponent agency is DARCOM.			
1. MAJOR ITEM	2. PREPARED BY		
3. PREPARING ORGANIZATION	4. NOMENCLATURE Filter Circuit		
5. PART NUMBER	6. DATE	7. REVISION NO.	

	A	B	C	D
8. FAILURE MODE(S)	RF Interference			
9. CLASSIFICATION	Marginal			

NO.	LOGIC QUESTION		YES	NO	INFORMATION SUMMARY
1	WOULD FAILURE CAUSE A SAFETY HAZARD OR MISSION ABORT?	A		X	10. No mission abort.
		B			
		C			
		D			
2	IS FAILURE HIDDEN?	A	X		11. Failure is hidden from operator/crew.
		B			
		C			
		D			
3	WOULD FAILURE AFFECT FUNCTION REQUIRED BY REGULATION OR STATUTE?	A	X		12. Failure can cause interference which is
		B			prohibited by statute/regulations.
		C			
		D			
4	WOULD MAINTENANCE PRIOR TO FAILURE BE MORE ECONOMICAL?	A			13.
		B			
		C			
		D			
5	CONDITION MONITOR	A			14.
		B			
		C			
		D			
6	COULD HIDDEN FAILURE LEAD TO SAFETY HAZARD OR MISSION ABORT?	A		X	15. Failure will not lead to mission abort.
		B			
		C			
		D			
7	CAN OPERATOR/CREW DETECT DEGRADATION DURING OPERATION?	A			16.
		B			
		C			
		D			
8	CONDITION MONITOR	A			17.
		B			
		C			
		D			
9	CAN HIDDEN FAILURES BE DETECTED BY PERIODIC INSPECTION?	A	X		18. Periodic inspection (operation check)
		B			can detect condition of RF interference.
		C			
		D			
10	CAN DEGRADATION BE DETECTED BY PERIODIC INSPECTIONS?	A	X		19. Include a periodic inspection to detect
		B			condition of RF interference. Operator
		C			performs a quarterly check to detect RF
		D			interference.
11	ON-CONDITION	A			20.
		B			
		C			
		D			
12	DOES RELIABILITY DEGRADE WITH AGE OR USAGE?	A			21.
		B			
		C			
		D			
13	HARD TIME	A			22.
		B			
		C			
		D			
14	CONDITION MONITOR	A			23.
		B			
		C			
		D			

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Figure 2–7. Maintenance Process Analysis Worksheet Example

g. Block 5 – Condition Monitor. It has been determined at this point that the existing or proposed inspection procedures or service is not required. Failure of the component or system to be inspected would not injure personnel or abort the mission either directly or indirectly, would not cause violation of an administrative or legal requirement, and the costs of the scheduled services cannot be justified on economic ground. Arrival at this block would indicate that this item would not be a candidate for entry into the PMCS table. The item would be operated until failure and then repaired or replaced.

h. Block 6 – Could Hidden–Failure Lead to Safety Hazard or Mission Abort?

(1) A YES answer to this question indicates that a Hidden failure whether part of a backup system or not could cause a mission abort or a safety hazard.

(a) YES Hidden failure could cause safety hazard. Check "YES" and continue with block 9.
Example:
Failure of electrical interlock system.

(b) YES Hidden failure could cause a mission abort. Check "YES" and continue with block 9.

Examples:

1. Failure of back–up alternator is not indicated to operator.
2. Failure of an over–voltage or over–current protection circuit.

(2) A NO answer indicates that a hidden failure would not lead to a mission abort or safety hazard. Check "NO" and continue with block 3.

i. Block 7 – Can Operator/Crew Detect Degradation During Operation?

(1) A YES answer indicates that degradation leading to failure can be detected by crew/operator during normal operations by monitoring panel indicator lights or gauges or sensing abnormal sounds, motions, or odors.

Note. Condition monitoring should be directed if it can be effective in detecting deterioration leading to a critical failure whether or not on–condition is also directed.

YES Operator/crew can detect degradation during operation. Check "YES" and indicate condition monitoring. If conditions indicate that condition monitoring will not provide the degree of protection required to prevent a mission abort or safety hazard then consider on–condition at organizational maintenance or higher.

Examples:

1. During operation – Check antenna tie down for proper connections (fig 2–3).
2. During operation– Check transmission oil temperature gauge –220 degrees F to 275 degrees F normal 300 degrees F maximum (see example, figure 2–8).
During operation – Observe for abnormal clutch operation –slipping or chattering. (See example, figure 2–9).

Note. On–condition inspections and tests will also be considered for critical failure modes. As indicated in block 8, the applicability of condition monitoring to detect deterioration does not preclude selection of an on–condition inspection or test which offers a higher probability of successful detection. For critical failures that can injure personnel, the analyst should always seek tests, inspections, or procedures which provide the highest assurance of safe operation. The analyst must assess whether the operator/crew can and will detect and report deterioration leading to failure. However, if there is concern that operators may fail to report all deteriorating conditions noticeable during normal operation, it would serve little purpose to double up the same procedure as a periodic check for the same operator. It would be appropriate to consider an on–condition check at an organizational maintenance level or higher under these circumstances.

4-2. Operator/Crew Preventive Maintenance Checks and Services

NOTE: The checks in the interval column are to be performed in the order listed.

B—Before Operation A—After Operation M—Monthly

D—During Operation W—Weekly

Item No.	Interval B	D	A	W	M	Item to be Inspected	Procedures	For readiness reporting equipment is not Ready/ Available if:
						Instruments and Gauges	Check instruments for normal indication:	
23		●					Engine Coolant Temperature Gauge 170 F Normal 225 F Maximum	
24		●					Engine Oil Pressure Gauge 50-70 psi at 2100 rpm 30-50 psi at 1000 rpm 70 psi maximum	
25		●					Transmission Oil Temperature Gauge 220 F to 275 F Normal 300 F Maximum	
26		●					Transmission Oil Pressure Gauge 5-40 psi Normal 10 psi at 1000 rpm minimum	
27		●					Battery-Generator Indicator Guage - Green Zone (Charging)	
28		●					Tachometer and Speedometer - Should operate without excessive fluctuation or unusual noises.	

Figure 2–8. Operator/Crew Preventive Maintenance Checks and Services Example

4-2. Operator/Crew Preventive Maintenance Checks and Services

NOTE: The checks in the interval column are to be performed in the order listed.

B—Before Operation **A—After Operation** **M—Monthly**

D—During Operation **W—Weekly**

Item No.	Interval B	D	A	W	M	Item to be Inspected	Procedures	For readiness reporting equipment is not Ready/ Available if:
						Cab		
1				●		Fire Extinguisher	Missing, seal broken, securely mounted	
2	●	●				Service Brake	Check brake pedal free travel (about 1/4 to 1 inch) pedal should be at least 2 inches from floor when fully applied	Service brake won't stop vehicle
3		●				Clutch	Check clutch pedal free travel (should be able to move clutch about 1 1/4 to 2 inches before feeling resistance); grabs, chatters, slips	No free travel; clutch slips
4		●				Transmission and Transfer Gear Shift Lever	Stuck, loose, bent, knob missing, boot torn	Does not go in or out of gear
5					●	Windshield Wipers	Wipers operate; blades are present, not torn, and are against glass	
6					●	Lights	Check operation of all lights	

Figure 2–9. Operator/Crew Preventive Maintenance Checks and Services Example

(2) NO Degradation leading to failure cannot be detected by the operator/crew during normal operation. Check "NO" and continue with block 10.

j. Block 8 – Condition Monitor. Indicate in the information summary column any additional information that may be required to aid in the evaluation. Consider the need for an on–condition inspection at the organizational level or higher for safety items and those that would cause mission failure.

k. Block 9 – Can Hidden Failures be Detected by Periodic Inspection?

(1) YES Hidden failures can be detected by an on–condition inspection or test that can be performed by organizational maintenance or higher. Check "YES" and indicate on–condition and any additional information in the summary blocks.

Examples:

(a) Decrease in radar receiving sensitivity (fig 2–6).
(b) Failure of backup alternator that can be tested by direct support.

(2) NO Hidden failure cannot be detected by periodic inspection or test. Check NO and continue with block 12.

Example:

Squib–activated components in missiles and munitions.

l. Block 10 – Can Degradation be Detected by Periodic Inspections? This portion of the logic is concerned with detecting degradation which if not corrected could lead to failure.

(1) YES Degradation can be detected by periodic inspection or test. Check "YES" and indicate on–condition in summary block plus any additional information that may be useful.

Examples:

(a) Oil analysis of engine oil.
(b) Ultrasonic inspection of rotor blades.
(c) Inspect deterioration of brake lining on a wheeled vehicle.
(d) Inspect engines using Special Test Equipment/Internal Combustion Engine (STE/ICE).

(2) NO Degradation cannot be detected by periodic inspection or test. Check "NO" and continue with block 12.

Examples:

(a) Deterioration prior to failure is either instantaneous or so rapid that detection prior to failure is impractical. Most failures of electronic components fit this category, such as resistors, capacitors, and transistors.
(b) Deterioration cannot be detected because of extensive disassembly In many cases, the item may have a high reliability or it would be impractical to expend the resources when it will be replaced at a more frequent time interval because of a different failure mode. Such items would include axles, differentials, frames, and electronic components.

m. Block 11 – Perform On–Condition Inspections. Indicate in the information summary columns the time interval, level of inspection, and any special tools or test equipment required.

Example:

Inspect engine monthly using STE/ICE.

n. Block 12 – Does Reliability Degrade with Age or Usage?

(1) A YES answer to this question indicates that there is a high correlation between age/usage and failure and/or degradation.

(a) YES Hidden failure degrades with age or usage. Test data should be used to determine the appropriate hardtime limit. Check "YES" and enter Hardtime in the summary block and include any additional information as required.

Examples:

1 Klystron tubes and magnatrons (fig 2–10).

2 Squib–activated components in missile and munitions.
3 Rocket motors that are used for one firing.

MAINTENANCE PROCESS ANALYSIS WORKSHEET

For use of this form, see DA PAM 750-40; the proponent agency is DARCOM.

1. MAJOR ITEM	2. PREPARED BY
3. PREPARING ORGANIZATION	4. NOMENCLATURE Klystron Tube
5. PART NUMBER	6. DATE / 7. REVISION NO.

	A	B	C	D
8. FAILURE MODE(S)	No output			
9. CLASSIFICATION	Catastrophic			

NO.	LOGIC QUESTION		YES	NO	INFORMATION SUMMARY
1	WOULD FAILURE CAUSE A SAFETY HAZARD OR MISSION ABORT?	A	x		10. Mission abort.
		B			
		C			
		D			
2	IS FAILURE HIDDEN?	A			11.
		B			
		C			
		D			
3	WOULD FAILURE AFFECT FUNCTION REQUIRED BY REGULATION OR STATUTE?	A			12.
		B			
		C			
		D			
4	WOULD MAINTENANCE PRIOR TO FAILURE BE MORE ECONOMICAL?	A			13.
		B			
		C			
		D			
5	CONDITION MONITOR	A			14.
		B			
		C			
		D			
6	COULD HIDDEN FAILURE LEAD TO SAFETY HAZARD OR MISSION ABORT?	A			15.
		B			
		C			
		D			
7	CAN OPERATOR/CREW DETECT DEGRADATION DURING OPERATION?	A		x	16. Operator/crew cannot detect degradation,
		B			
		C			
		D			
8	CONDITION MONITOR	A			17.
		B			
		C			
		D			
9	CAN HIDDEN FAILURES BE DETECTED BY PERIODIC INSPECTION?	A			18.
		B			
		C			
		D			
10	CAN DEGRADATION BE DETECTED BY PERIODIC INSPECTIONS?	A		x	19. Degradation cannot be detected by periodi
		B			inspection.
		C			
		D			
11	ON-CONDITION	A			20.
		B			
		C			
		D			
12	DOES RELIABILITY DEGRADE WITH AGE OR USAGE?	A	x		21. These items have known failure rates.
		B			
		C			
		D			
13	HARD TIME	A	x		22. Replace after 500 hrs by organization
		B			support.
		C			
		D			
14	CONDITION MONITOR	A			23.
		B			
		C			
		D			

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Figure 2–10. Maintenance Process Analysis Worksheet Example

(b) YES Degradation prior to failure cannot be detected. Decrease in reliability correlates closely with age or usage. Check "YES" and indicate Hard–time in the summary block.

Note. Confidence in the ability to detect deterioration prior to failure is especially important when personal injury is at stake. Correlation of reliability degradation with usage must be supported by test data.

Example:

Replacement of gun tubes upon reaching the limit of equivalent full charge rounds fired.

(2) NO Deterioration leading to failure is not detectable. Failure is detectable. Reliability does not decrease with age or usage or the decrease in reliability does not correlate closely with age or usage. Check "NO" and indicate in the summary block "condition monitor for failure."

Example:

Many electronic components such as printed circuit boards fit this category. Even if reliability objectives for the system are not met, they cannot be improved by hardtime replacement of components which exhibit an exponential failure distribution.

Note. If reliability or readiness objectives for the system are not met, consideration should be given to design changes to improve component reliability, to add redundancy to improve system reliability, or to develop a means of detecting deterioration prior to failure.

o. Block 13 – Replace at Hard–time Limit. Indicate in the information summary column the limit that replacement should be made plus any additional information that may be required.

p. Block 14 – Condition Monitor or Consider Redesign. No scheduled tasks are required. Indicate in the information summary column what the indications of failure would be. If redesign is indicated, note the maintenance task to be performed after redesign has been accomplished.

Chapter 3
Determination of Interval

3–1. General

The determination of interval cannot be considered apart from the choice of the detection method. For example, a requirement for an excessive number of frequency checks can rule out an on–condition procedure. The selection of method should not be considered final until the interval is determined. In addition, procedures should be combined into common intervals wherever possible in order to reduce overall costs and scheduling complexity.

3–2. On–condition – Detection of Deterioration

a. Detection prior to failure can be accomplished only if the inspection occurs during the period between the onset of noticeable deterioration and the occurrence of failure. The term Time of onset (Tos) is applied to this period. (Refer to figure 3.1.).

b. Tos is statistically estimated to simulate performance with different inspection schemes (mixes and intervals) in order to select a least cost option that provides high calculated values of reliability and availability.

c. The following are examples of Tos:

(1) Time or usage interval from when oil level just falls below level of sight gauge of road wheel (unacceptable condition) until there is insufficient oil present to preclude damage.

(2) Time or usage interval from start of an oil leak until a rupture takes place or until damage results from insufficient oil.

(3) Time or usage interval from when fan belt is first noticeably frayed until failure occurs.

(4) Time or usage interval from when battery electrolyte level first falls below split rings until insufficient electrolyte remains to sustain operation or preclude battery damage.

(5) Time or usage interval from when one or more hub nuts is noticeably loose (can be tightened) until wheel falls off hub.

d. Tos must be estimated for every failure mode exhibiting detectable deterioration prior to failure. The engineering and technical judgment of Materiel Readiness Command personnel should be combined with the technical judgment and experience of user personnel to establish a range of values for each estimate.

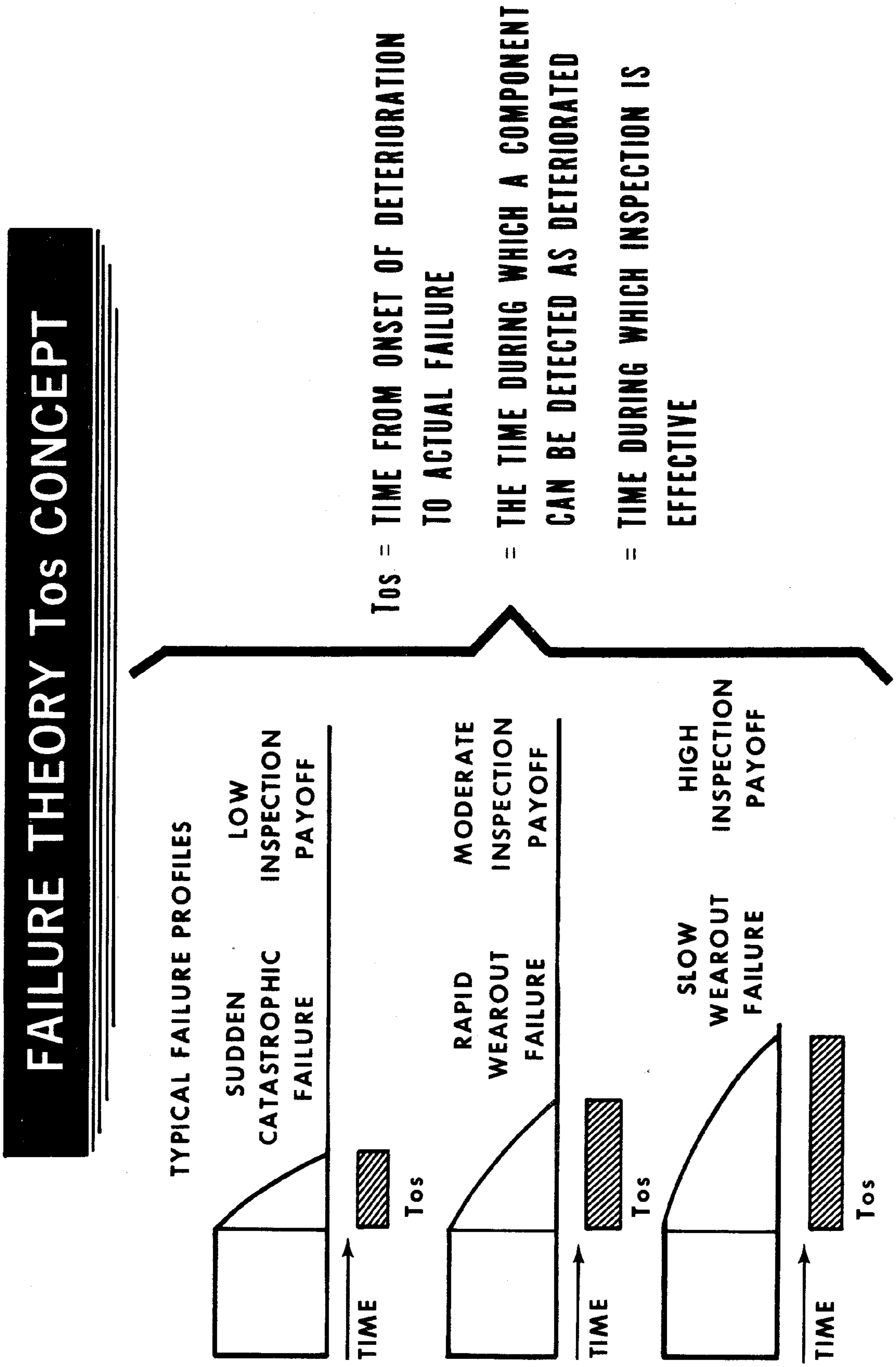

Figure 3–1. Failure Theory Tos Concept

e. The interval selected should be the largest that provides an acceptable likelihood of successful detection. For example, if Tos for a failure mode is estimated to be in the range of two to four months, a monthly check will provide essentially the same likelihood of detection prior to failure as a daily check with a much lower expenditure of resources. For reliability failures (safety not directly affected), it is suggested that the interval be set near the shortest interval of the range estimated for Tos. For safety failures, a smaller interval would be appropriate – perhaps one third to one half of the shortest estimated interval.

3–3. On–condition – Detection of Hidden Failures
The time required to perform an inspection for these components that cannot be monitored during normal operations should be minimal. Failure should be detected during only a small percentage of the inspections. However, if the percentage is very minute, the interval would be viewed as too small from a cost standard.

3–4. Hard–Time Limits
a. Replacement at hard–time limits must be supported by statistically sound test data. The failure distribution should be determined in addition to the mean time or usage to failure. Replacement at hard–time limits is most effective when there is a close correlation between reliability and age or usage; e.g., the variance about mean time or usage to failure is narrow.

Example:

Failure probability distribution approximates a normal function with a standard deviation equal to five percent of the mean. If the hard time limit for replacement is set at 85 percent of the mean, approximately 0.15 percent will fail prior to replacement. If the standard deviation were 20 percent of the mean, it would be necessary to set the hard time limit at 40 percent of the mean in order to limit the failure percentage to the same 0.15 percent.

b. Tests, data collection, and analysis should continue after the initial value of hard–time limit is set. The limits should be adjusted as required to obtain the maximum usage compatible with safe and reliable operation. The evaluation should also stay abreast of improvement in diagnostic techniques such as oil property tests and ultrasonic tests which may enable a cost effective switch to on–condition maintenance.

Chapter 4
Verification and Analysis

4–1. Verification
DARCOM will demonstrate revised PMCS procedures on the end item in order to verify technical accuracy and completeness. The procedures will be reviewed and verified by TRADOC in accordance with AR 310–3 and the DARCOM–TRADOC Technical Documentation and Training Acquisition Handbook.

4–2. Analysis
a. Initial Analysis. Preventive maintenance is an essential element of the Army's Preventive Logistics Program (DA Circular 700 series). It is also a resource–consuming burden. The preparing activity and its counterpart TRADOC proponent school and/or logistic oriented school(s) must determine the magnitude of the burden and assess whether it is reasonable and enforceable. A two–hour check procedure for a ground vehicle is probably neither and is unlikely to be performed. Experience with several examples of lengthy preventive maintenance requirements has demonstrated that the application of RCM logic can produce enormous reductions in the requirement without adversely affecting safety and reliability. However, this guide sets no target goal for reductions or target ceiling for preventive maintenance requirements. In some instances, the RCM analysis produced added requirements.

b. Engineering Analysis. A burdensome preventive maintenance requirement should not be viewed as an appropriate or long–term solution to a poor system design or unreliable components. While design improvements are obviously easier to effect during initial system development, an active reliability improvement program is an important facet of reliability centered maintenance for fielded systems as well.

c. Continuing Analysis. Continuing feedback is a shared responsibility of the preparing activity and the various MACOM personnel who operate and maintain the equipment. The former seek feedback from its logistics assistance personnel and weapon system assessments and the latter report problems using TAMMS reports and other forms of correspondence. The need for improvements and corrections must emanate from user experience with the hardware and the maintenance requirements. It is especially important that non–acceptance and non–performance of requirements be reported and considered an unacceptable condition.

The objectives of RCM are met only when preventive maintenance is actively performed at the minimum essential level required to obtain safe and reliable weapons system performance.

Glossary

Section I
Abbreviations

This section contains no entries.

Title not used.
Paragraph not used.

Section II
Terms

Catastrophic Failure
A failure which may cause death or weapon system loss, i.e., aircraft, missile, tank, ship, etc.

Condition Monitoring
Condition of equipment is monitored during normal operation or start up procedures without detracting from actual operation. The operator/crew is directed to monitor for specified abnormal conditions in the during operation column of a Preventive Maintenance Checks and Services (PMCS) table. The condition monitored item may normally be corrected by the operator/crew or be operated for the duration of the mission without any adverse effects.

Critical Component
The item identified in the equipment/system whose failure may result in a mission abort, mission failure, personal injury, or equipment damage, or loss of function required by regulation or statute.

Critical Failure
A failure which may cause severe injury, major property damage, or major system damage which will result in mission loss.

Deterioration
Degradation in quality, mission accomplishment, and/or reliability due to age, usage, or environment.

Failure
Any deviation from the design–specified, measurable tolerance limits that cause either a loss of function or reduced capability.

Failure Effects
The consequences of failures.

Failure Mode
The state of operation or condition after or during failure.

Function
The characteristic actions of units, systems, and end item.

Functional Test
The quantitative evaluation of a system or component to assure its ability to perform over the full operating range as designed, within specified limits, and to detect deterioration.

Hard–Time Limit
Scheduled maintenance tasks that are performed at a predetermined, fixed interval because of age or usage such as operating time, flying hours, miles driven or rounds fired.

Hidden Failure
A failure which is undetectable during operation by the operator/crew.

Incipient Failure
A deteriorated condition that indicates that a failure is about to occur.

Inherent Design Level of Reliability
That level which is built into the hardware item, and therefore is inherent in its design. This is the highest level of

reliability that can be expected from the hardware item. To achieve higher levels of reliability generally requires modification or redesign of the hardware item.

In–Service Reliability
That characteristic of design and installation that will ensure a system's (equipment's) capability to operate satisfactorily under given conditions for a specified period of time.

Marginal Failure
A failure which cause minimal injury, property damage, or system damage which will result in mission delay or mission degradation. Special operating techniques or alternative modes of operation involved by the loss can be tolerated throughout a mission but shall be corrected upon its completion.

Minor Failure
A failure not serious enough to cause injury, property damage, or system damage but which will result in unscheduled maintenance or repair after completion of a mission.

Mission Abort
The termination of a mission prior to completion in which the failure cannot be repaired within 30 minutes by the on–board basic issue load list.

On–Condition
Maintenance is performed or item is replaced based upon the condition of the item as determined by an evaluation of each item performed on a scheduled basis.

Redundant System
A system composed of two or more components, below major item level, either of which is capable of performing the same mission or function independently of each other.

Example:

1. Two launchers in a Hawk battery are not a redundant system. The launchers are considered major items.
2. Two hydraulic pumps in an aircraft, one primary and the other secondary are considered a redundant system since each can perform the same function independently of the other.
3. The tank turrent system is operated with a redundant system:
(a) Electro–hydraulic.
(b) Manual.
4. The brake system and the parking brake system on a vehicle would not be considered redundant. The brake system function is to slow or stop the motion of a vehicle. The function of the parking brake is to hold a vehicle once it has stopped.

Reliability Centered Maintenance
a. Reliability Centered Maintenance (RCM) is a precept which uses an analytical methodology or logic for influencing design maintainability and reliability and for establishing specific maintenance tasks for materiel systems or equipment.
b. Intrinsic to RCM is the identification of critical failure modes through engineering analyses and/or field experience, determination of the related consequences, analysis of an interaction between failure probability and a maintenance task to detect the incipient condition of failure, and determination of the most effective apportionment of maintenance activities. Non–critical tasks are included only when performance of the task produces cost effective results. The three types of maintenance actions are:

Time of on set (Tos)
the period between the onset of noticeable and unacceptable deterioration and the occurence of failure.

Section III
Special Abbreviations and Terms
This section contains no entries.

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