D E P A R T M E N T O F T H E A R M Y T E C H N I C A L B U L L E T I N

PHASE MAINTENANCE SYSTEM FOR ARMY AIRCRAFT

Headquarters, Department of the Army, Washington, D. C.
18 May 1984

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedure, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, US Army Aviation Systems Command, ATTN: DRSAV-MPSD, 4300 Goodfellow Blvd., St. Louis, Missouri 63120. A reply will be furnished to you.

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*This TB supersedes TB 55-1500-337-24, 17 December 1975, including all changes.

Section I. INTRODUCTION

1. Purpose. This bulletin shall direct implementation of the Phase Maintenance System. In addition, this bulletin has the following objectives:

a. Describes the Phase Maintenance System.

b. Explains Inspection Requirements.

c. Provides Changeover Instructions.

d. Provides Transfer Instructions.

2. Scope. This bulletin explains phase maintenance and provides direction in areas not covered by the applicable aircraft Phase Maintenance Checklist Technical Manual.

3. Arrangement. This bulletin consists of four sections and one appendix. Sections I and II consist of the introduction and guidance for the Phase Maintenance System.
Section III provides Phase Maintenance approach to optimizing preventive maintenance.
Section IV provides changeover instructions.

Section II. IMPLEMENTATION OF PHASE MAINTENANCE SYSTEM

4. Receipt of Technical Bulletin and Maintenance Checklists. This Technical Bulletin is being distributed worldwide and covers all types of Army aircraft. As Phase Maintenance Checklists for various types of Army aircraft are developed or revised, * they will also be distributed worldwide. Upon receiving this Technical Bulletin and the applicable Phase Maintenance Checklists, aviation activities are hereby directed to immediately begin changeover to the Phase Maintenance System on all assigned aircraft covered by these checklists.

Section III. PHASE MAINTENANCE SYSTEM

5. Name Designation. In keeping with technical language most often used in industry and the armed forces, the Army has decided to identify the phase inspection system as Phase Maintenance. Therefore, the expression Phase Maintenance shall be used regularly in this bulletin, the applicable checklists and other Army documents covering Army aviation maintenance.

6. Phase Maintenance Cycle.

a. Phase Maintenance of aircraft is a system of scheduled maintenance. The interval between phase inspections is assigned a flight hour value for the type aircraft (i.e., UH-1H, 150 flight hours; CH-47C, 200 flight hours, etc.).

b. A phase maintenance cycle is also assigned a flight hour value for the type aircraft (i.e., UH-1H, 900 flight hours; CH-47C, 800 flight hours, etc.). The number of phase inspections per cycle is determined by dividing the flight hours in one cycle by the flight hours in one phase (i.e., UH-1H, 6 phases; CH-47C, 4 phases, etc.).

c. When all phase inspections for an aircraft have been completed, the aircraft has completed one cycle and the sequence of phase inspections repeats. After completing one cycle, the next phase inspection is phase one, cycle two (i.e., the second cycle).

d. The phase maintenance inspection system intervals designated are the maximum and shall not be exceeded except in actual operational emergencies. It is the Commander's responsibility to determine (on an individual aircraft basis) when inspection intervals may be exceeded. When unusual local conditions (utilization, type of mission personnel, periods of inactivity, environmental conditions, etc.) dictate, it is the prerogative and responsibility-of the Maintenance Officer to increase the scope and/or frequency of maintenance or inspection as necessary to insure safe operation (TM 55-1500-328-25).

e. Because of different maintenance characteristics, different types of aircraft may have a different number of phases in one cycle and/or a different number of flying hours between phases, as shown below:

	No. of Phases	Time Between Phases (Flight Hours)
EH-1H/EH-IX	6	150
UH-1C/H/M/V	6	150
CH-47B/C	4	200
CH-47D	6	100
CH-54A/B	4	100
OH-58A/C	4	300
AH-1G/S (Mod/Prod)	4	150
OV-1/RV-1	2	300
U-21A/G	2	300
RU-21A/B/C/D/H	2	300

After sequence of phase maintenance services, a cycle is completed and the sequence repeats. By the time a cycle is completed, all parts and systems of the aircraft requiring maintenance will have been inspected and maintained at least once.

7. Basic Maintenance Studies.

a. In 1972-1973, the Army performed studies of UH-1H and CH-47C aircraft component failure and maintenance characteristics, using a computer program, MAVIS (Model for Analysis of Vehicle Inspection System). The studies showed that components require less frequent maintenance than prescribed by the intermediate/periodic system. The Phase Maintenance System is the result of these studies.

b. To confirm the mathematical evaluation obtained by the computer, a field test of the Phase Maintenance System was considered to be highly desirable. Therefore, field evaluation programs were set up with the selected active Army, Reserve, and National Guard Units.

8. Phase Maintenance Field Evaluation and Optimum Phase Maintenance System.

a. Field testing and evaluation of the Phase Maintenance System was conducted from August 1974 to November 1975, and again in 1981 and 1982 to optimize previously obtained data. These field evaluations confirmed the result of the computer mathematical evaluations. Although both the computer and the field evaluations were made

only on the UH-1H and CH-47C helicopters, the nature of the maintenance systems and evaluations is such that conclusions can be extended to all aircraft. No substantial disadvantages of the Phase Maintenance System have been found. Advantages of the Phase Maintenance System were already demonstrated and included:

(1) More flexibility in managing maintenance operations.

(2) Significant increase in aircraft availability.

(3) Significant reduction in maintenance work hours.

(4) Significant reduction in spare parts usage.

(5) Some of the present intermediate/periodic maintenance requirements can be eliminated because they are not necessary.

b. An optimum maintenance system provides-maximum cost effectiveness while maintaining safety of flight. Many effectiveness indicators can be applied to a maintenance system. These indicators are ultimately related to the comparative frequency of preventive maintenance versus unscheduled maintenance. Preventive maintenance is preferred particularly if it is completed on a scheduled basis. Scheduled preventive maintenance allows less frequent flight schedule disruptions, less costly repairs and minimizes secondary damage due to premature failure. Failures which result in unscheduled maintenance reduce mission readiness, reliability and safety. The quantitative indicators of a maintenance system's effectiveness are:

(1) Aircraft safety.

(2) Reliability.

(3) Maintainability.

(4) Operational readiness.

(5) Maintenance work hours.

(6) Spare parts usage.

Qualitative indicators of a maintenance system's effectiveness are:

(1) Flexibility to plan scheduled inspections effectively.

(2) Adaptability to diverse operating schedules.

(3) Adaptability to diverse or variable environmental conditions.

(4) Adaptability to diverse mission demands.

9. Phase Maintenance Approach to Optimizing Preventive Maintenance.

a. Selection of components for preventive maintenance is based on the nature of the naturally occurring degradation process for each component. Any components or systems will eventually degrade and fail to the point of being ineffective.

b. Some components fail suddenly with no warning signs. For these components there can be no preventive maintenance. For them, scheduled maintenance is only a waste of time and money.

c. Other components show warning signs of impending failure, but for only a short period of time. For these components, scheduled maintenance may catch the early stages of degradation and produce some beneficial effects, such as a slight improvement in operational readiness, but the cost of preventive maintenance is too high. The net effect of scheduled inspections for this class of components is low payoff in operational readiness and high economic cost. An optimum maintenance system would consider this class of components to be not suitable for preventive maintenance.

d. A third group of components show warning signs of impending failure for an extended period of time before failure. This is the group where preventive maintenance has a high payoff in increased operational readiness and in reduced maintenance costs. By arranging the components in phases over a cycle, scheduling of preventive maintenance is easily managed. This is the main reason for phasing maintenance over a period of time. In addition, duplicate inspections routinely conducted on a daily basis by the flight crew, the crew chief and also by maintenance personnel were assigned during phase checklist workup for only one inspection in order to save work hours. Therefore a practical optimum maintenance system was developed in the form of phase maintenance.

e. In preparing the Phase Maintenance Checklists and the Daily Checklists, the following information was used:

(1) Compilation of components for phased maintenance.

(2) Compilation of components to be maintained daily.

(3) Compilation of distinct component mixes for phase maintenance.

(4) Calculation of optimum time interval between phases.

(5) Calculation of number of phases per cycle.

10. Preventive Maintenance Requirements. Preventive maintenance requirements are summarized in the daily and phase maintenance checklists. The applicable -23 technical manual contains the specific details and procedures for accomplishment of these requirements. Special inspection requirements are contained in the applicable -23 technical manual and phase maintenance checklists. In cases where revision to the -23 technical manual has not been completed to include new requirements, the new requirements for special inspections are covered in the applicable phase maintenance checklist.

Section IV. INSTRUCTIONS

11. Changeover Instructions, Periodic to Phase.

a. Changeover instructions in this technical bulletin cover Army aircraft. As other aircraft are changed to phase maintenance, these instructions shall apply.

b. Each aircraft shall begin changeover to the phase system immediately upon receiving Phase Maintenance System Checklists and this technical bulletin.

c. The changeover time period is the time interval between completion of the last periodic inspection and the time when the first phase inspection is due. During this interval, services only will be performed instead of complete intermediate inspections. Services consist of lubrications, taking oil samples for analysis, changing filters are required and avionics and armaments servicing. Special inspections contained in the -23 technical manual will be performed as required at the specified intervals.

d. The first phase maintenance inspection, Phase No. 1, is due after a number of flying hours equal to the interval between phases have elapsed since the last periodic inspection. (Example: For the AH-IS aircraft, the initial Phase No. 1 inspection is due 150 flying hours after the last periodic inspection.) In addition to meeting the requirements of all tasks in the Phase Maintenance Checklist, each aircraft shall be given a complete safety of flight inspection. Safety of flight inspection shall consist of meeting all critical inspection requirements of the complete Phase Maintenance System, including daily and all phases. Each critical inspection requirement is printed in bold type in the Daily and Phase Maintenance Checklists. Special inspection requirements will also be accomplished.

e. Items due for maintenance before being scheduled on the Phase Maintenance Checklist need special attention. To prevent exceeding the intervals required by the Phase Maintenance System, maintain the item at the first maintenance phase. Then future maintenance shall be as scheduled in the checklist. Time intervals between maintenance of some items change when going from the old PMI/PMP System to the Phase Maintenance System. In such a case, time interval between maintenance actions during the changeover time period shall be as required by the Phase Maintenance System.

f. Changeover is complete and the aircraft is on Phase Maintenance when the following actions have been completed:

(1) All tasks in new Phase Maintenance Checklist.

(2) Safety of flight inspection.

(3) All required special inspections.

(4) All additional items required to avoid exceeding the allowable time intervals.

12. Changeover Instructions for Phase Maintenance Interval Change.

a. Changeover instructions in this technical bulletin cover Army aircraft. When previously established aircraft phase maintenance intervals are changed, these instructions shall apply.

b. Changeover to the new phase maintenance interval will be accomplished at the next scheduled phase inspection under the old phase time interval. Transition to the new phase inspection interval is accomplished by performing a complete phase inspection

(all tasks in the new phase maintenance checklists), all required special inspections, safety of flight inspections, lubrication orders, and preventive checks will be performed as listed in existing publications and messages.

c. The first new phase maintenance inspection will be Phase No. 1, Cycle 1 and will be when the new flying hour interval between phases has elapsed since the old phase inspection. (Example: For the UH-1H/V aircraft, the initial new phase No. 1, Cycle 1 inspection is due 150 flying hours after the old 100 hour phase inspection.) d. Changeover is completed and the aircraft is on new phase maintenance when the following actions have been completed;

(1) All tasks in new phase maintenance checklist.

(2) Safety of flight inspections.

(3) All required special inspections.

(4) All additional items required to avoid exceeding the allowable time intervals.

13. Transfer of Aircraft. Transfer of aircraft covered by this technical bulletin occurs for an activity on phase maintenance. For transfer instructions, refer to TM 55-1500-326-24, Standards of Serviceability for Transfer of Aircraft.

14. Entry in Historical Records. An entry shall be recorded on the DA Form 2408-15, Historical Record for Aircraft, when the aircraft is placed on phase maintenance (i.e., at beginning of the changeover period). The entry shall include date and aircraft time (flight hours) when placed on phase maintenance and time (flight hours) when Phase No. 1 is due. An example of the entry is:

"A/C placed on phase maintenance 26 Oct 76 at 2314.6 aircraft hours, IAW TB 55-1500-337-24. Phase maintenance inspection No. 1 due at 2400."

APPENDIX A
REFERENCES

Army and joint military documents referring to the Phase Maintenance System include, but are not limited to the following:

Army Regulations	
AR 310-2	Identification and Distribution of DA Publications and Issue of Agency and Command Administrative Publications
AR 310-3	Preparation, Coordination and Approval of Department of the Army Publications
AR 750-1	Army Materiel Maintenance Concepts and Policies
AR 750-31	Technical Publications for Aircraft Files
Technical Manuals	
TM 38-750	The Army Maintenance Management System (TAMMS)
TM 55-1500-326-24	Standards of Serviceability for Transfer of Aircraft
TM 55-1500-328-25	Organizational, Direct Support and General Support Maintenance Manual: Aeronautical Equipment Maintenance Management Policies and Procedures
	Technical Bulletins
TB 43-0106	Aeronautical Equipment Army Oil Analysis Program (AOAP)
	Field Manuals
FM 55-411	Army Aircraft Control and Technical Inspection
FM 101-20	US Army Aviation Planning Manual

By Order of the Secretary of the Army:

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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