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MANAGEMENT SUMMARY REPORT AH-IG

Army Aviation Systems Command
Saint Louis, Missouri

28 July 1972

USAAVSCOM TECHNICAL REPORT 72-28

MANAGEMENT SUMMARY REPORT

AH-1G

SUMMARY REPORT

PREPARED BY THE PERSONNEL OF THE

DIRECTORATE FOR PRODUCT ASSURANCE

SYSTEMS PERFORMANCE ASSESSMENT DIVISION

JULY 1972

US ARMY AVIATION SYSTEMS COMMAND

ST. LOUIS, MO.

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13 ABSTRACT

This report presents the results of an independent assessment of the reliability, availability, and maintain ability attained by the fleet of subject Army aircraft presently deployed. (U)

This report is management oriented, providing significant information through narrative description, tabulated data, and trend-line charts on the basis of data accumulated over a two year time span including the most recent quarter available through current reporting procedures. The basic format has been organized using a systems, subsystem/component approach. (U)

Emphasis is placed on basic areas requiring management coordination. Problem identification in the areas of aircraft operations and maintenance as related to inadequacies of the reliability and maintainability aspects of the equipment is based on the analysis of data available from several sources including the TAERS/TAMMS system, Army Aircraft Inventory and Flight Status Reports, Crash Fact Messages, Field Service Reports, and Product Quality Inspection Summaries. (U)

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Reliability						
Availability						
Maintainability						
Management Summary						

As the scope of the information base increases with the availability of additional operational RAMMIT Reports, present subject areas may be expanded and chapters included to cover other areas of significant import to top-level management. The status of RAMMIT Reports is provided in Appendix B to indicate those reports which are currently available and those which will be available in the near future.

PREFACE

The Reliability and Maintainability Management Improvement Techniques (RAMMIT) System was originally developed to validate and utilize the data reported through the TAERS/TAMMS System. Present reports of the RAMMIT System integrate TAERS/TAMMS data with other sources of usage, maintenance and field experience information to assimilate a comprehensive feedback system on the performance of Army aircraft in the inventory. With the further development of this system and the corresponding increase in availability of reports, it became evident that a need existed for a summary report which would present the interrelationships of the current RAMMIT Reports. It was anticipated that the basic design of the report should encompass significant problem areas of aircraft operations and maintenance as related to inadequacies of reliability and maintainability aspects of present equipment. This report fulfills the original expectations of a summary report and is intended for use by top-level management.

This report, which pertains to the aircraft of the TMS fleet indicated on the title page, is concerned with the significant observations and statistics related to those subject areas listed in the table of contents. The summarized facts and figures, which include the most recent data available through current reporting procedures, are also relevant to operational safety and costs. The intent is to emphasize basic areas requiring coordination to achieve the dual objective of improving personnel safety while reducing the level of operational costs.

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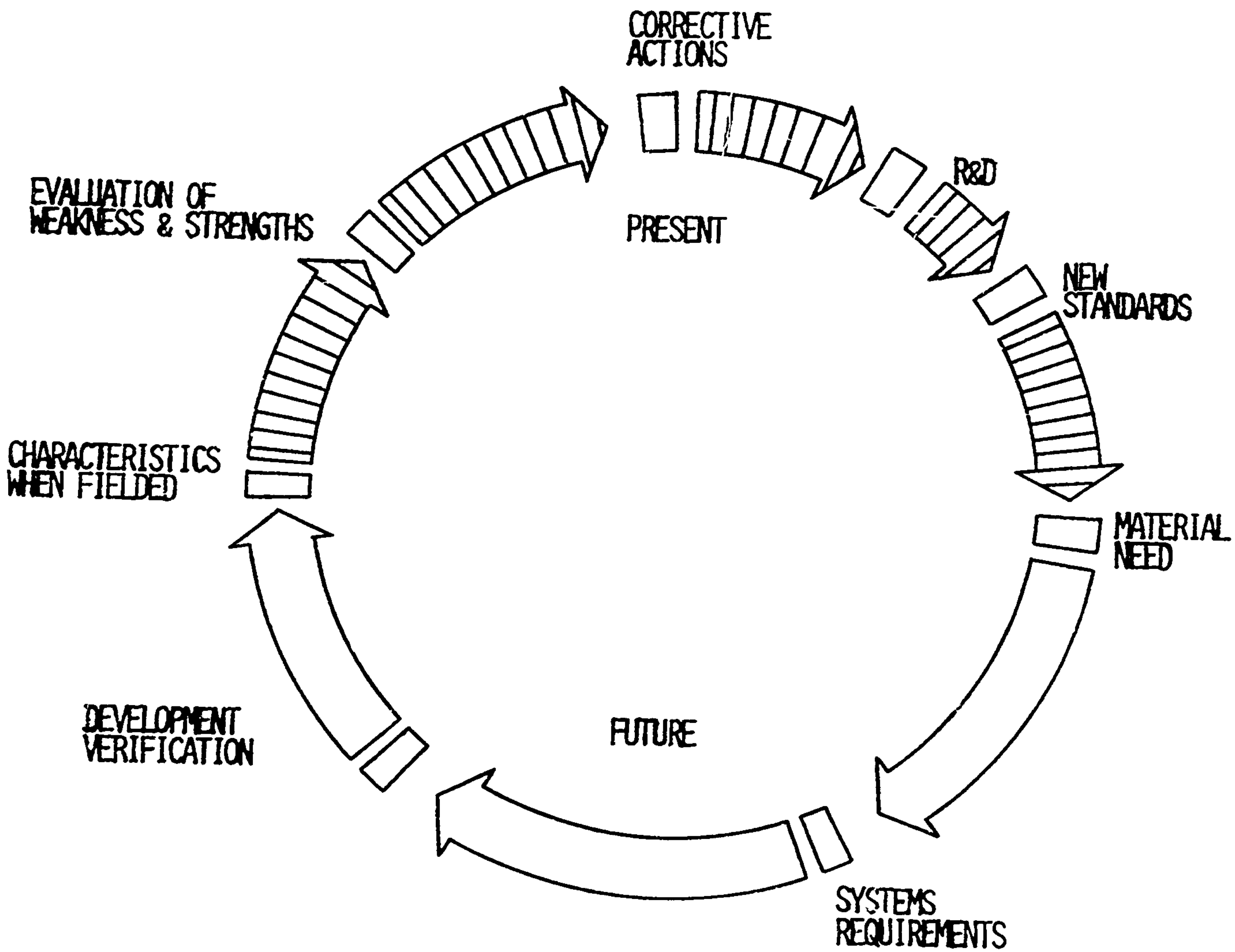
INTRODUCTION

This Management Summary Report is one of several which are prepared for selected fleets of Army aircraft. These reports have many purposes and are designed to furnish information regarding the experiences of fielded aviation equipment. Information is specifically directed at both support and developmental organizations in aviation management with confidence that present and future equipment can be more efficiently and effectively employed with fewer resource requirements.

There are several Army data collection systems which are utilized in the derivation of information and analysis of fielded aviation equipment experiences. Data collected from these systems are compiled in various detailed, automated RAMMIT Reports which are described in Appendix B. These reports are intended for use by all levels of management and engineering personnel in providing improved logistical support and are available upon request.

This report is primarily intended for top-level management and as such is not obscured with excessive detail. Since field experiences can be viewed from many different perspectives, this report is limited to concentration on those subjects which indicate influences on aircraft mission accomplishments and supporting resource requirements. Although focus of the report is primarily aimed at present day aircraft configuration, it also encompasses considerations which should be anticipated in the development of future generation equipment. To more clearly relate the total objectives of this report, a graphic display of the "Life Cycle R&M Experience Plan" is provided on the succeeding page. A synopsis of this display is as follows:

LIFE CYCLE R&M EXPERIENCE PLAN



PRESENT EQUIPMENT (in the inventory)

Efforts are directed toward measuring the characteristics which identify the maintainability and reliability obtained in the actual field environment. Once the characteristics have been determined, efforts are expended in evaluating the weaknesses and strengths of the aircraft; initiating corrective actions to eliminate these deficiencies through product improvement programs, ECP's, maintenance procedures, etc.; initiating R&D efforts for new materials and processes or new applications of materials and processes; and establishing new standards that equipment should demonstrate, thus setting goals for present equipment and minimum acceptance levels for new equipment.

FUTURE EQUIPMENT (to be developed)

As new material needs are made known, the information on past and present equipment is utilized to formulate an R&M model (quantitative expressions of what equipment should demonstrate when placed in the field environment for which it was intended). As material needs are further defined, refinements are made to the R&M models. These models are then used to formulate system requirements which the equipment must satisfy prior to acceptance for introduction into the inventory. These requirements are verified by demonstration and testing throughout the developmental efforts. Upon acceptance into the inventory, the cycle is continued as with our present equipment.

In essence, this report synthesizes all factors which directly or indirectly influence the ultimate purpose of a fully operational fleet of aircraft: mission accomplishment. It is not feasible nor desirable to present all possible parameters in a summary type report. Therefore, this report is limited to presenting what is considered significant. There are several major categories of data analyzed in acquiring relevant information from field experience records. Presently, this data base is limited due to a lack of time and resources. As resources become available, additional pertinent information will be added to this report.

In general, this report is dually oriented. An examination of the table of contents will reveal that the information of the first part of the report is end-item oriented while the latter portion is component oriented. This format is followed for the convenience of the user, and does not detract from the logical integration of the report.

Where evident through analysis, significant observations and/or recommendations for corrective action are made following the discussion portion of a particular subject. These recommendations are directed to those organizations with the authority and responsibility to rectify the indicated problem. It should be noted that the recommendation is made by the analyst although he may not have knowledge of all the actions previously taken or being developed by responsible organizations. In other words, the recommendations are limited by the information available to the engineering analyst.

Presently this report incorporates the basic design of future reports regardless of the availability of data.

FLEET AIRCRAFT
CHARACTERISTICS

MISSION:

The AH-1C aircraft were procured per the Procurement Detail Specification to perform the following missions:

"The mission of this aircraft shall be that of an armed tactical helicopter capable of delivering weapons fire, low altitude high speed flight, search and target acquisition, reconnaissance by fire, multiple weapons fire support and troop helicopter support. The aircraft shall be capable of performing this mission from prepared or unprepared areas, day or night flying and to navigate by dead reckoning or by the use of radio aids to navigation".

PERFORMANCE REQUIREMENTS:

The aircraft shall be capable of the following performance under International Civil Aviation Organization (ICAO) standard air conditions (unless otherwise specified) at a gross weight of 8000 pounds and an aft cg FS 201.0. The installed armament shall be the XM-28 turret and two LAU 3A/A 19-round rocket pods.

		Estimated*	Guaranteed
Engine rating (1100 shp limit)	shp	1100	
Speed at sea level (6600 rpm) (1100 shp)	kts	149.0	144.0
Maximum redline airspeed	kts	190.0	
Maximum endurance at sea level with 1600 pounds of fuel. Fuel includes 10 percent reserve plus warm-up and take-off allowance. Does not include 5 percent increase in engine specification sfc. (6600 rpm)	hrs	3.3	3.0
Operating radius at cruising speed at sea level 1600 pounds of fuel. Fuel includes 10 percent reserve plus warm-up and take-off allowance. Does not include 5 percent increase in engine specification sfc. (6600 rpm)	nmi	155.0	148.0

Best rate of climb at 1100 shp limit at sea level (6600 rpm)	fpm	2125	1800
*Service ceiling Normal Rated Power (NRP) (6600 rpm)	ft	18200	
Hovering ceiling Out of Ground Effect (OGE) (6600 rpm) (a) with 95°F Operating Air Temp. (OAT)	ft	2600	2000
Military Rated Power (MRP) (b) with ICAO Std. (OAT) (MRP)	ft	9500	
Vertical rate of climb 1100 shp Limit at sea level (6600 rpm)	fpm	940	590

*Based upon "Preliminary Engineering Test Report of the Bell Huey Cobra, US Army Activity dated March 1966."

NOTE

Performance is predicated on the XM-28 turret having the same aero-dynamic drag as the TAT-102A turret.

The above performance is based on using a T53-L-13/T53-L-13A/T53-L-13B Shaft Turbine Engine, and JP-4 fuel. All performance items are without the Government Furnished Aircraft Equipment particle separator or foreign object damage screen installed and without the environmental control system operating.

Engine Performance Data: The engine data which applies to this aircraft is provided in Specification No. 104.33 dated 30 Sep 1964, revised 30 Jul 1965, 6 May 1966, 30 Sep 1969 - Lycoming Division of AVCO Manufacturing Corporation, covering T53-L-13/T53-L-13A/T53-L-13B Shaft Turbine Engine.

FEATURES OF DESIGN AND CONSTRUCTION:

Fuselage: The fuselage which is 44' 5.2" long and stands 11' 7" high from the ground line to the center line of main rotor hub consists of two main sections, the forward section and the aft section. The forward section includes the tandem two-man crew cockpits, alighting gear, wings installation, power plant and pylon assembly. The aft section supports the cambered fin, tail skid, elevator, tail rotor and tail rotor drive system.

The most destinctive features of the AH-1G are the narrow fuselage (36 inches), the stub midwings with four external stores sections and the integral chin turret (see Illustrations 1 and 2).

Gross Weight: The design gross weight (grwt) is 6600 pounds and the maximum grwt is 9500 pounds.

Center of Gravity: The center of gravity, limits for interval loading of the helicopter are as follows:

The most forward CG limit below 7000 lbs. is FS 190.0 and linear increase to FS 192.1 at 9500 lbs. Aft CG limit below 8270 lbs. is FS 201.0 and linear decrease to FS 200 at 9500 lbs.

Crew: Tandem seating is provided for a two-man crew. The pilot's station is located forward of the pylon assembly and the gunner's station is located directly forward and below the pilot.

Airframe:

Overall length (Rotor Turning)	637.2"
Overall width (Rotor Trailing)	124.0"
Center line of main rotor to center line of tail rotor .	320.7"
Center line of main rotor to elevator hinge line	198.6"
Elevator area (Total)	15.2 sq ft
Elevator area (both panels)	10.9 sq ft
Elevator airfoil section	Inverted Clark Y
Vertical stabilizer area	18.5 sq ft
Vertical stabilizer airfoil section	Special Camber
Vertical stabilizer aerodynamic center	FS 499.0
Wing Area:	
Total	27.8 sq ft
Outboard of BL 18.0 (both sides)	18.5 sq ft
Wing Span:	10.33 ft
Wing Airfoil Section:	
Root	NACA0030
Tip	NACA0024
Wing Angle of Incidence:	14 Degrees

Main Rotor System: The main rotor assembly is a two-bladed, semi-rigid, seesaw-motion, underslung feathering axis type rotor. The assembly consists basically of two all-metal blades, blade grip yoke extensions, yoke trunnion, and rotating controls. Each blade is connected to yoke assembly

ILLUSTRATION 1

AH-1G THREE-VIEW DRAWING

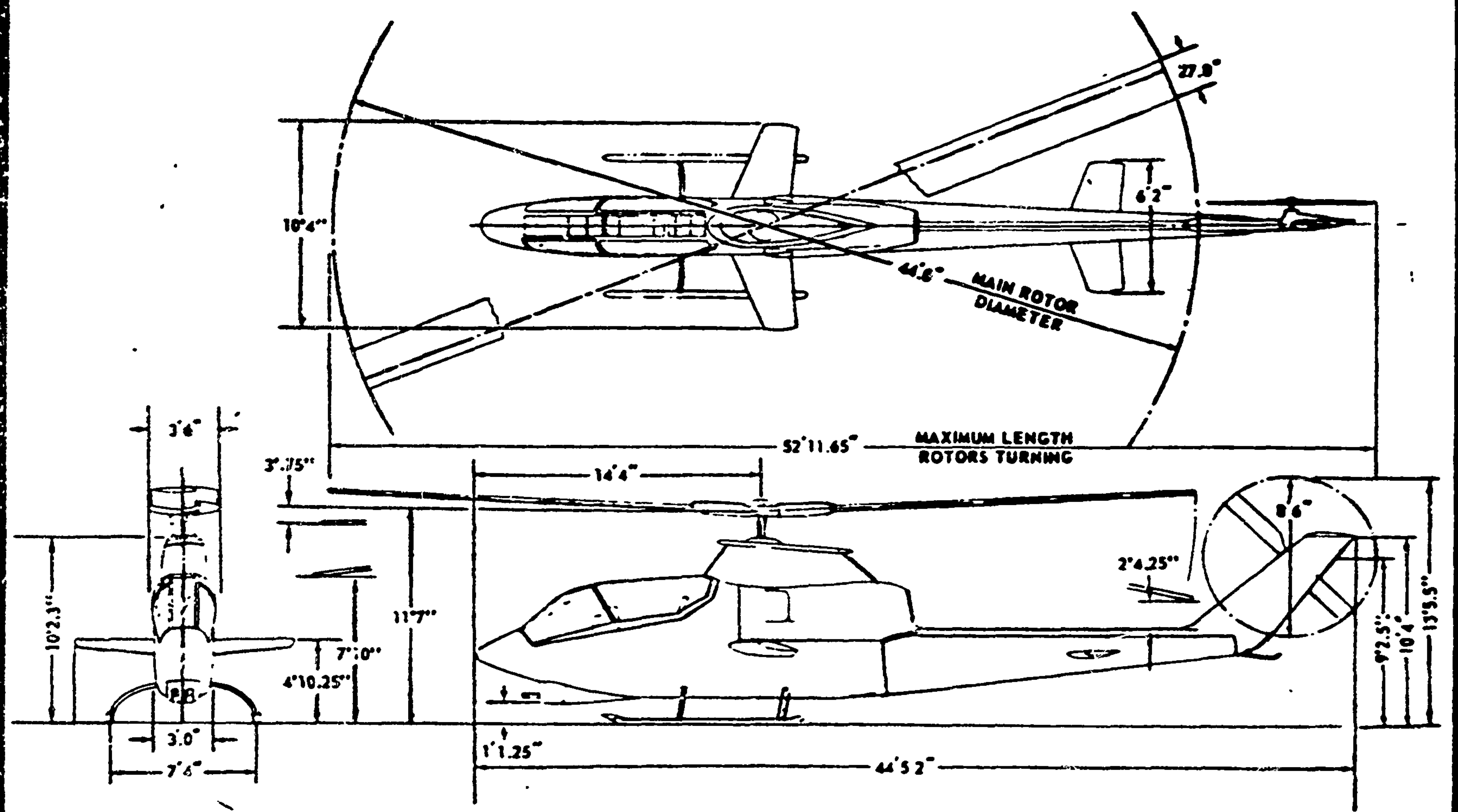
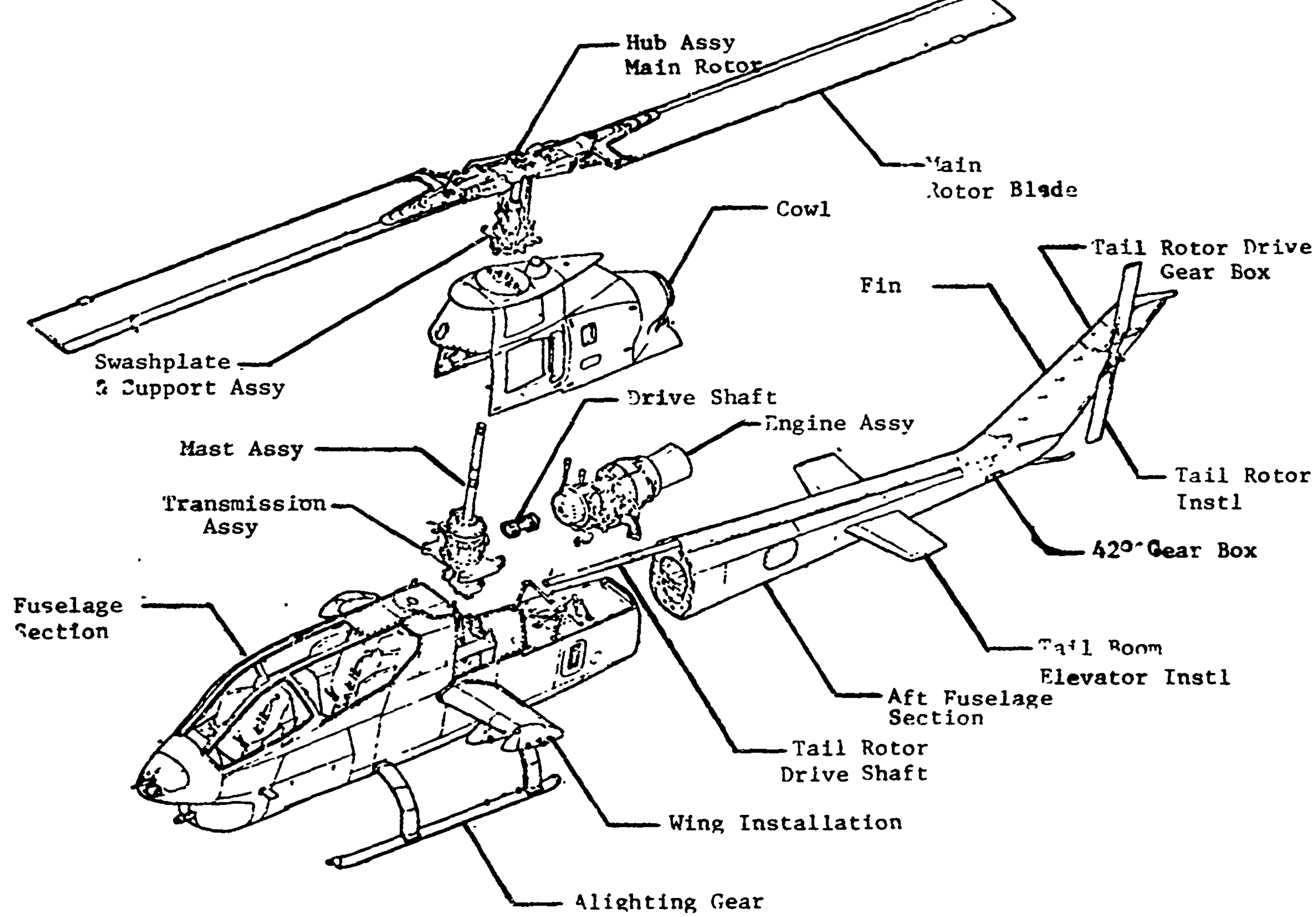


ILLUSTRATION 2

AH-1G GENERAL ARRANGEMENT



by means of the blade grips and a suitable pitch change bearing with tension straps to carry the centrifugal force. The seesaw motion of the rotor takes place about the axis perpendicular to the spanwise axis of the rotor. Control horns for cyclic and collective control input are mounted on the trailing edge of the blade grip. The rotor is mounted to the mast by means of a trunnion through the seesaw bearings to permit rotor flapping. The blade grip to yoke extension bearings permit cyclic and collective pitch action. The weight and balance of each blade is controlled to ensure complete interchangeability by adjusting ballast at time of manufacture.

Tail Rotor: The tail rotor is a tractor type two-bladed, semi-rigid, delta-hinge type employing preconing and underslinging. The blade and yoke assembly is mounted to the tail rotor shaft by means of a delta hinge trunnion to minimize rotor flapping. Blade pitch angle is varied by movement of the tail rotor control pedals to increase or decrease the pitch of the blades. Power to drive the tail rotor is supplied by a take-off on the lower end of the main transmission. Dimensional control of the hub assembly is maintained to insure interchangeability of individual blades.

Power Plant: The engine section is that section above the aft portion of the fuselage. This section consists of engine mounting provisions, firewalls, and cowling.

The firewalls, which are constructed of titanium and stainless steel, consists of the horizontal deck under the engine, a vertical bulkhead at the engine inlet, and a shroud around the engine exhaust section.

The cowling encloses the engine and transmission sections and is of honey comb reinforced fiberglass and/or aluminum alloy construction. The cowling has hinged cowl panels which provide easy access for inspection and servicing of engine, transmission and drive shaft. The left and right forward panels are hinged on the forward side and open to expose the transmission and pylon support area and the engine inlet. The left and right rear panels are hinged on the aft side and open to provide access to the engine compartment, fuel control, and accessories.

The AH-1G helicopter is powered by a Lycoming T53-L-13 turbo-shaft engine rated at 1400 shaft horsepower (SHP) at sea level under standard day, uninstalled conditions. The engine is derated to 1100 (SHP) due to the maximum torque limit of the helicopter's main transmission.

The engine is mounted in horizontal position above the aft portion of the fuselage. The engine is removable from the aircraft by disconnecting the engine controls and piping, and removing the connecting shaft, cowling and engine mounting bolts.

Primary Flight Control System: The primary flight control system consists of cyclic, collective, and tail rotor pitch controls. The controls are routed as directly as possible through the aircraft by means of a series of push pull tubes and bellcranks. Positive stops are provided in the system to prevent movement of the controls beyond safe limits. The flight controls consist of a cyclic control stick for lateral and longitudinal control, a collective control lever incorporating a twist grip for engine power control, and foot pedals for directional control.

The cyclic control sticks actuate the lateral and longitudinal controls of the main rotor. The pilot's cyclic control sticks incorporate stock centering controls and force gradient system. The gunner's side arm controls are mechanically connected to the pilot's controls Both the lateral and longitudinal systems incorporate push-pull tubes, bellcranks, and a dual hydraulic system. Hydraulic boost cylinders are incorporated in the fixed control system to prevent control-force feedback under all normal operating conditions and maneuvers. The stick centering device is designed to provide desirable force gradients at the hand grip. The entire system includes provisions for inspection. Adjustment means are provided at a minimum of easily accessible points in the longitudinal and lateral systems.

The tail rotor pitch control pedals alter the pitch of the tail rotor blades and thereby provide the means for directional control. The force trim system is connected to the directional controls and is operated by the force trim switch on the cyclic control grip.

Collective pitch control is located to the left of the pilot and is used to control the vertical mode of flight. Operating friction can be induced into the control lever by hand tightening the friction adjuster. The pilot's and gunner's collective pitch controls have a rotating griptype throttle.

Stability and Control Augmentation System (SCAS): The SCAS is a three-axis, limited-authority, rate-referenced stability augmentation system. It includes an electrical input which augments the pilot's mechanical control input. This system permits separate consideration of airframe displacements caused by external disturbances from displacement caused by pilot input. The SCAS is integrated into the fore, aft, lateral and directional flight controls to improve the stability and handling qualities of the helicopter. The system consists of electro-hydraulic servo actuators, control motion transducers, a sensor/amplifier unit and a control panel. The actuators are limited to a 25% authority and will center and lock in case of an electrical and/or a hydraulic failure.

Hydraulic System: Dual hydraulic systems are provided. The pressure and return lines from each pump are separated to the largest extent possible. The hydraulic reservoirs and modular components assemblies are mounted on opposite sides of the aircraft. An accumulator, check valve and pressure operated shut-off valve is installed in system number 1. Hydraulic lines to the cyclic and collective servo actuators are separated, by system, everywhere except at the connector on the servo valve. The hydraulic lines to the tail rotor control servo and stability augmentation equipment is separated from hydraulic lines to the armament system at all locations. Protective boots are provided to protect the hydraulic power cylinder from dirt and oils.

Electrical System: The electrical system is a 28 volt DC single conductor system with the generator negative lead grounded to the main structure. Power characteristics of the electrical system conforms to the requirements of MIL-STD-704.

Emergency Electrical System: The electrical system is a dual bus system supplied by the starter-generator and battery. There is essential and non-essential bus. In the event of a starter-generator failure, the non-essential bus is automatically disconnected from the generator and battery bus and the battery automatically supplies the essential bus loads. The emergency system is capable of supplying the essentail bus loads for at least 30 minutes in the event of starter-generator failure.

Jettison Controls: Primary selective electrical jettison controls are provided for the pilot. Emergency salvo electrical jettisoning controls are provided for both the pilot and gunner which will permit jettison of wing stores. The controls are located on the left side of each cockpit adjacent to the collective pitch lever. The single-phase 150VA static inverter is installed and is utilized to provide emergency AC electrical power. An appropriate switching circuitry to transfer the aircraft AC electrical load from the primary inverter to the standby inverter is provided. The inverter transfer switch functions are clearly identified and conveniently located for operation by the pilot.

Fuel System: The fuel system includes a tank consisting of two interconnected crashworthy self-sealing fuel cells. Each cell contains a submerged fuel pump. In addition, the fuel system includes a shut-off valve, fuel quantity transmitters, an indicator, drain valve in each cell, a 10 micron filter with impending bypass warning fittings and connecting lines. The engine is capable of suction feeding without boost pumps to an altitude of 6000 feet. The fuel system is compatible with JP-4 and JP-5 grades of fuel.

The fuel tank consists of two interconnected self-sealing fuel cells located in the fuselage, in the area aft of the pilot's cockpit and below the engine and pylon compartment.

Drain valves are installed at the lowest point in the system to provide for defueling. In addition to gravity defueling, the aircraft may also be defueled by use of the fuel pumps located in the fuel cells.

The fuel control is designed to be operated either automatically or in an emergency mode. In the emergency position, fuel flow is terminated to the main metering valve and is routed to the manual (emergency) metering and dump valve assembly. While in the emergency mode, fuel flow to the engine is controlled by the position of the manual metering valve which is connected directly to the power control (twist grip).

In the emergency mode, there is no automatic control of fuel flow during acceleration and deceleration; thus exhaust gas temperature and engine acceleration must be pilot monitored.

Instruments & Instrument Panel: Flight, navigation and power plant instruments for use by the pilot and gunner are plainly visible from their stations with minimum practicable deviation from normal position and line of vision when looking out and forward along the flight path. The pilot's instruments are installed substantially in accordance with the Army Standard "T" panel arrangement. The gunner's instrument panel contains only essential instruments and presents minimum information for flight to return from a mission once instigated, and for emergency use. Operating limits are indicated on the instrument glass. All instruments are removable from the front of the panel. The pilot and gunner's panels are shocked mounted.

Utility Systems Environmental: The environmental control system utilizes engine bleed air to provide personnel comfort by controlling temperature and humidity. Personnel comfort is provided with an outside temperature of from 65° to 95°F and an absolute humidity of 0 to 183 grains of moisture per pound of dry air. In the heating mode an inside temperature of +40°F is obtained with an outside temperature of 0°F within 10 minutes of initiation.

Ventilating System: The cabin ventilation system, which serves as a backup system for the environmental control system, is capable of providing outside air at a minimum rate of 450 feet per minute linear flow measured at the crew member's head and groin. The cabin air inlet is located so as to eliminate ingestion of noxious fumes caused by weapons firing. Two air outlets are provided at each crew station.

Air Induction System: The air induction system consists of recessed ramp type inlets in the engine cowl, a plenum chamber surrounding the engine inlet, a retractable engine air inlet screen, GFE, Lycoming particle separator, and GFE foreign object damage screen. A pressure sensing device is provided to warn the pilot and gunner of inlet screen blockage. In the event that inlet screen blockage occurs, the inlet screen may be retracted allowing the incoming air to bypass the screen.

Exhaust System: The engine exhaust system is designed to assure safe disposal of exhaust gases without existence of a fire hazard or carbon monoxide contamination of air in the crew compartment.

Armament: The aircraft is capable of carrying and firing various combinations of weapons within the aircraft's weight and center of gravity limitations with adjustments in expendable load. The armament configurations are changed by varying the wing stores and the chin turret configurations. The pilot can fire the wing stores and the chin turret only in the stowed position. The gunner operates the flexible turret and can also fire the wing stores in an emergency. The wing stores can be jettisoned by either the pilot or gunner in case of emergency.

The armament installation is designed so that frangible rocket pod fairings, rock debris, ejected cartridges, cases, and links do not endanger or damage the aircraft or external stores. Adequate clearance is provided between projectiles and all parts of the aircraft or external stores. Adequate safety provisions are incorporated to preclude collision of projectiles in near proximity of the aircraft. The armament installation is designed so that weapon blast and noise have no significant detrimental effect on the crew, aircraft, other weapons, or performance of the mission.

Gunner's Sight: The gunner's sight is installed as part of the XM28 Armament Subsystem. The sight mounting will permit the gunner to move the sight about the cockpit area to the extent necessary for target acquisition and tracking throughout the azimuth and elevation limits of the turret.

The gunner's control panel is installed as part of the XM-28 Armament Subsystem. The gunner has the capability to fire weapons from the cyclic control. The gunner is not capable of firing any weapons simultaneously except for two identical weapons firing from the turret. The gunner is not capable of interrupting fire initiated by the pilot except when the gunner's override pilot switch is in the on position.

When the gunner's action switch is released, the turret automatically returns to the forward stow position.

Pilot's Sight: A pilot's sight (XM-73) is installed as part of the XM-28 Armament Subsystem.

The pilot has the capability of selection of any of four different types of rockets which have been loaded. Ripples of one, two, four, eight, or all of, either single or pairs may be selected and fired. In addition, the pilot has the capability of selecting and firing any weapon or weapons carried on the external stores stations. The pilot can select the rate of fire of 7.62MM (turret gun(s)) through a firing switch on the cyclic stick. In addition, a separate firing switch is provided on the cyclic stick for the wing stores.

The pilot is not capable of firing any weapons simultaneously except for two identical weapons firing from the turret or identical weapons fired from the wing stations. The pilot is not capable of firing weapons when the gunner's override pilot switch is in the on position.

Indicators are provided as part of the GFAE pilot's control panels. The indicators are a complete digital readout of remaining rockets.

Target Marking: A wing-mounted smoke grenade dispenser system is provided which will hold 24 smoke grenades to use for target marking. The installation will enable the pilot to eject one grenade at a time or up to four grenades of different colors simultaneously. A positive release indication is provided. The smoke grenade fire switch is located on the pilot's collective stick switch box. The rocket control and display system provides the capability of stand-off target marking utilizing the 2.75 inch rockets.

Avionics Equipment: All electronic equipment is located for ease in servicing and maintenance. One C-1611(A)/AIC intercommunications control and the C-7197/ARC-134 VHF control for the AN/ARC-134 VHF radio are installed in the gunner's compartments. All other avionic equipment controls are installed in the pilot's compartment. Flush-mounted antennas are used where practicable.

Air-Weather Subsystems: A defrosting system is provided which meets the general requirements of MIL-T-5842. The design of the defrosting system is such that heated air is directed to the forward and side transparent areas. The air source for the defrosting system is engine compressor bleed air.

Defogging: Defogging is provided for the windshield and pilot's side panel area. Defogging is provided utilizing the ducting of the distribution system.

Anti-Icing: Anti-Icing is available for the windshield and pilot's side panel area. The anti-icing system utilizes the same air and routing as for defogging.

Engine: A manually operated engine anti-icing system is provided.

MAINTAINABILITY REQUIREMENTS:

The aircraft and its related subsystems are designed in accordance with maximum maintainability as a goal. Special consideration is given to provisions for access, rapid removal and replacement of components.

VULNERABILITY REQUIREMENTS PASSIVE DEFENSIVE SUBSYSTEMS:

The passive defense subsystem consists of protective armor, fire suppression, and leak preventative means which are installed to enhance crew and system survivability. The performance requirements of the protective material are as follows:

Opaque Armor Material: The opaque armor material used conforms to MIL-S-46099 or MIL-A-46103.

Chest and Torso Protection: Both the gunner and the pilot are required to wear a chest and torso protector similar to FSN 8470-NTK-5601 with carrier, which is GFAE. Design of the basic seat and side panels take into consideration the amount of protection afforded by this protector.

Protective Seats: Protective seats are provided for both the gunner and pilot. The basic seats consist of the seat bottom, sides, and back. Additional protection is provided by side-shoulder panels and head protection panels which may be easily installed and removed. The protective material employed in the basic seats and side panels are constructed of opaque armor material. The seats are designed to give an equivalent of greater protection to the air crew than the present UH-1D armored seat.

Power Plant: The engine compressor, fuel control, oil filter and fuel filter are protected to the greatest extent possible utilizing opaque armor material.

Fuel System: Self-sealing fuel cells are provided and protected to the following levels.

Bottom 33% capacity . . . . 50 caliber
Center 33% capacity . . . . 50 caliber

The remaining capacity is tear resistant.

Engine Oil System: An automatic emergency oil cooler bypass system is provided, a cockpit warning light and a system activation switch. The bypass line is located on the opposite side of the aircraft from the standard oil supply and scavenge supply lines.

Transmission: An automatic emergency oil cooler bypass system is provided with cockpit warning light and a system activation switch.

Hydraulic System: The dual hydraulic systems are physically separated to reduce the probability of a single round incapacitating both systems. The pressure and return lines from each pump are routed in a different direction to provide maximum separation. The hydraulic reservoirs and modular components assemblies are mounted on opposite sides of the aircraft. An accumulator, check valve, and pressure operated shut-off valve will be installed in system No. 1. Hydraulic lines to the cyclic and collective servo actuators are separated by system everywhere except at the connector on the servo valve. The hydraulic lines to the tail rotor control servo and stability augmentation equipment is separated from hydraulic lines to the armament system at all locations.

Flight Controls: Wherever possible, the pilot's cyclic and collective primary flight control push-pull tubes are a minimum of 1.25 inches in diameter.

RELIABILITY REQUIREMENTS:

AVAILABILITY REQUIREMENTS:

SIGNIFICANT OBSERVATIONS:

The Detail Specification for Model AH-1G Helicopter - 71 Series did not include quantitative requirements for:

a. Reliability.

b. Maintainability.

c. Operational Readiness (availability).

FLEET INVENTORY, CALENDAR AND FLIGHT HOUR AGE

The purpose of this chapter is to analyze the factors affecting fleet inventory and determine significant trends of the specific parameters to aid in future procurement policies.

The data gathered to present this chapter was made available from the following sources:

a. Aircraft Operational Utilization Reports from April 1, 1967 through March 31, 1972.

b. Aircraft Inventory Status and Flying Time Report for March 1972.

c. Procurement contract production schedule.

The results of the data analyzed is presented in three illustrations and two tables.

Illustration 1 presents the size of the AH-1G fleet from the time this type aircraft came into the Army inventory in March 1967. The average number of aircraft in the fleet from March 1967 through March 31, 1972 was 482 aircraft per quarter. The flight hour age distribution since new and the calendar age distribution since new are presented respectively in Illustrations 2 and 3. By examining the age of the fleet through these two parameters, intuitive judgements can be made on the need for reviewing existing component procurement policies. As the age of the fleet increases further, there will be a proportional emphasis on refining these procurement policies. Presently, the AH-1G inventory is comprised of 638 aircraft.

With respect to flight hours, it is noted that on the average an aircraft has accrued 38.7 hours per month from the time it came into the Army inventory to the present. If this rate remains constant, it is expected that at least 50% of the fleet will have accumulated 4544 flight hours or more after its first decade of existence. Although the end item aircraft will have accumulated a high number of flight hours in 10 years, many of the parts, components, and assemblies will not have collected this many hours due to previous replacements. This suggests that any decisions made in regards to retirement of an aircraft should be made in conjunction with specific salvage policies for parts, component and assemblies. For example, those assemblies which exhibit low flight hours on an aircraft about to be retired, may be salvaged for support of the remaining aircraft in the AH-1G fleet. Since the AH-1G are still in production, it can be assumed that a well managed salvage program is advantageous when supporting a new fleet. Assemblies can be retired on the basis of component life being realized and all other assemblies should be returned back to the inventory. In regard to the calendar age distribution, approximately 75% of the fleet has surpassed two years of operation. The hashline intervals indicate the number of aircraft yet to be delivered from April 1, 1972 through February 28, 1973 in quarterly intervals.

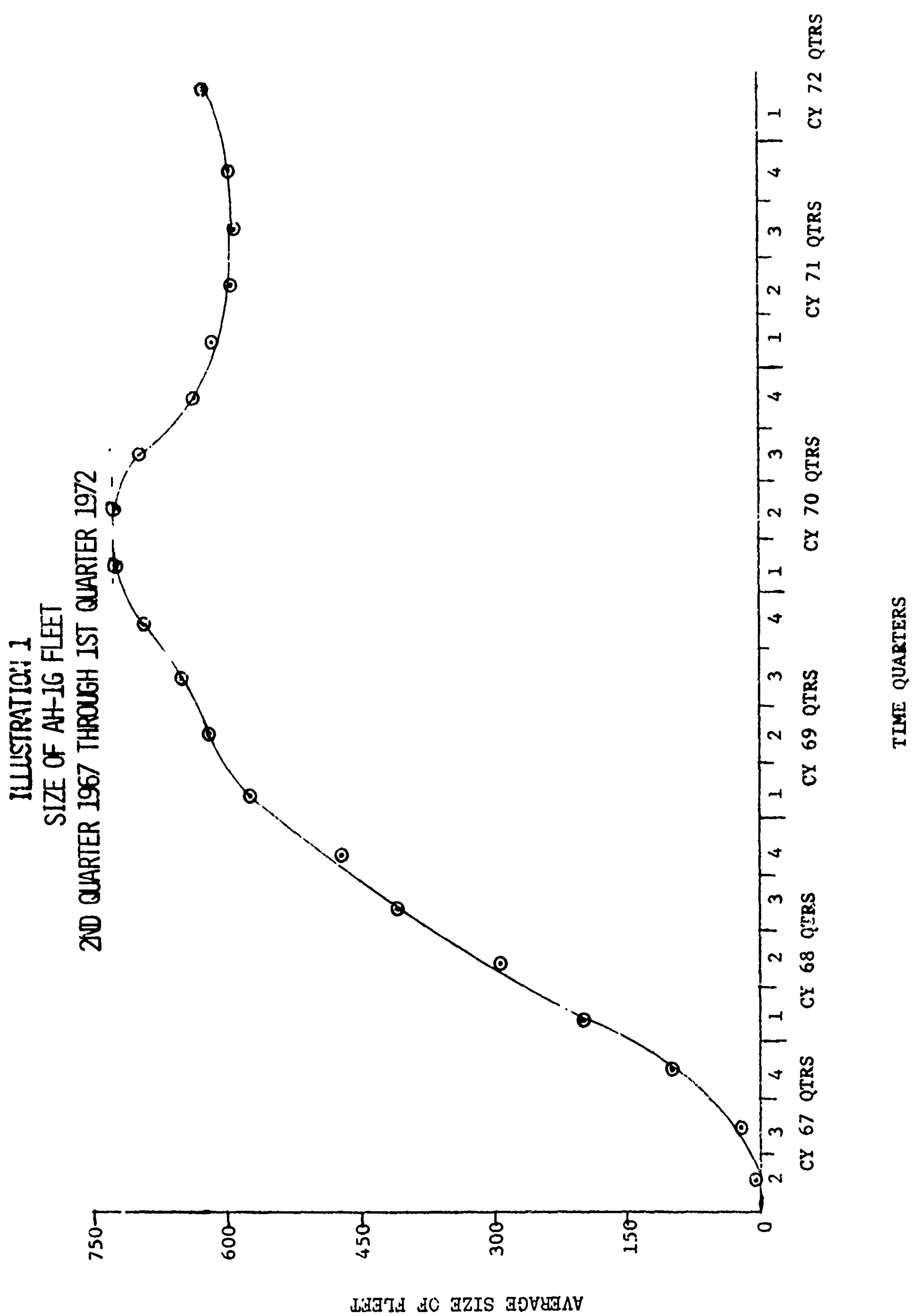


ILLUSTRATION 1
SIZE OF AH-1G FLEET
2ND QUARTER 1967 THROUGH 1ST QUARTER 1972
AVERAGE SIZE OF FLEET
0
150
300
450
600
750
TIME QUARTERS
CY 67 QTRS
CY 68 QTRS
CY 69 QTRS
CY 70 QTRS
CY 71 QTRS
CY 72 QTRS

ILLUSTRATION 2

FLIGHT HOUR AGE DISTRIBUTION SINCE NEW
ON 31 MARCH 1972

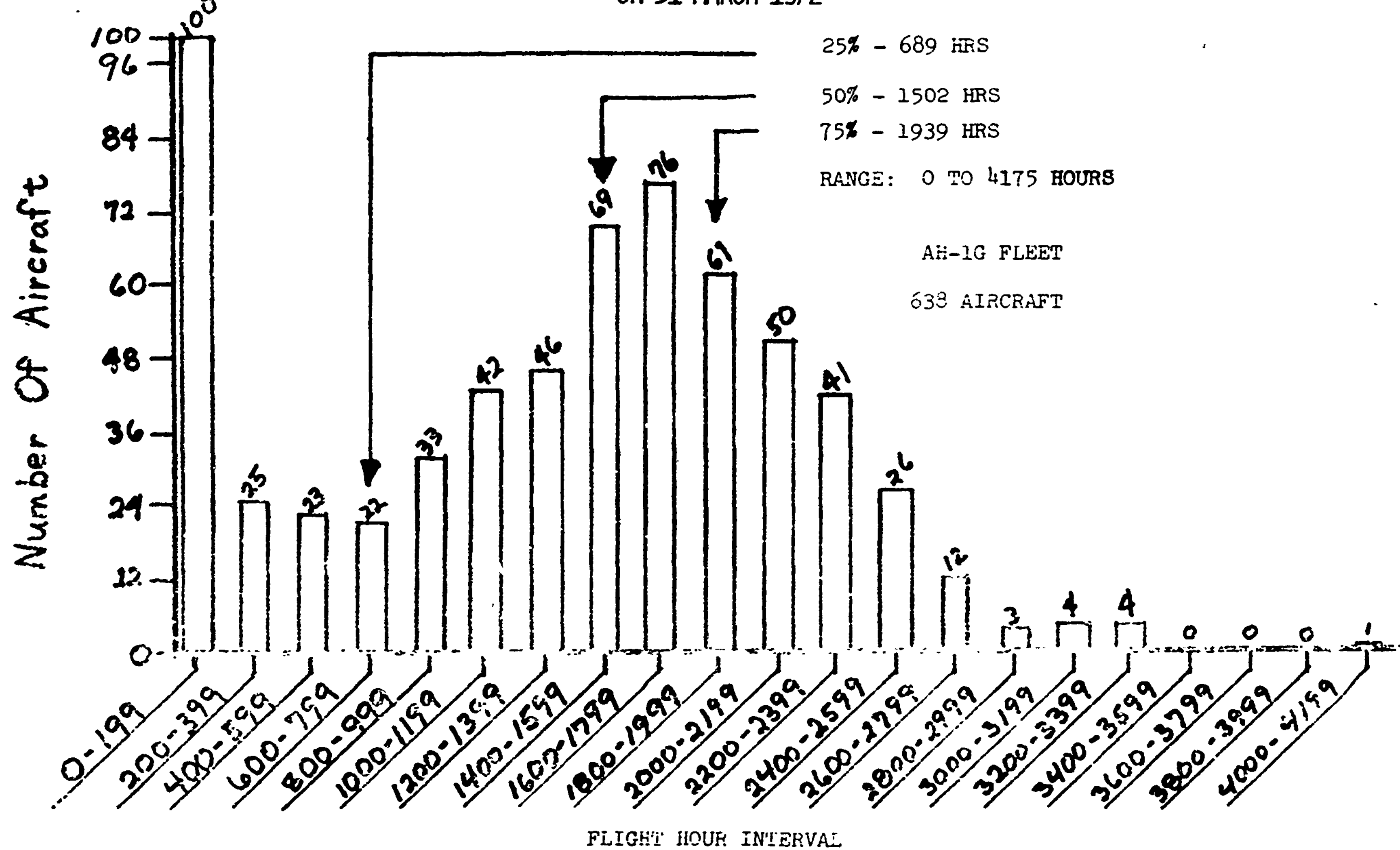
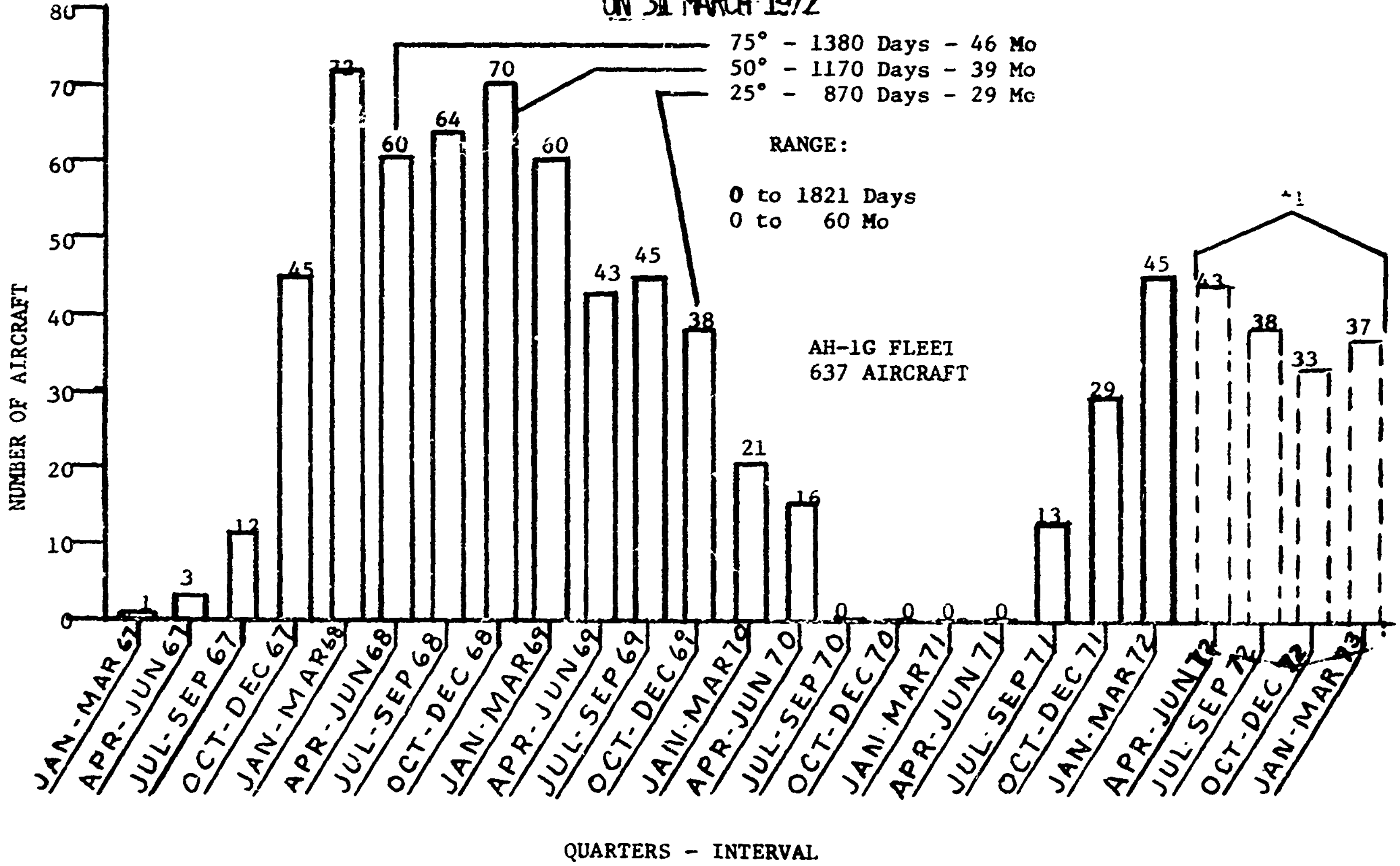


ILLUSTRATION 3

CALENDAR AGE DISTRIBUTION SINCE ACCEPTANCE DATE

ON 31 MARCH 1972



*1 - Aircraft Yet to be Delivered (Apr of 1972 - Feb of 1973, Quarterly Intervals)

Table 1 presents the serial number of all AH-1G aircraft which have entered the Army inventory. Of the total 892 aircraft accepted by the Army to date, approximately 28% have been removed from the inventory for various reasons. At some later date, analysis will be made to determine the reason that the aircraft were removed from the inventory. A breakout of the percent per production year of the total 254 serial number removed and the percent removed from the total production year inventory is shown in the following table:

PRODUCTION YEAR	% OF THE 254 AIRCRAFT REMOVED BY PRODUCTION YEAR	% OF THE PRODUCTION YEAR AIRCRAFT REMOVED
1966	11.4	32.2
1967	55.1	34.6
1968	31.9	29.8
1969	1.6	10.5
1970	0.0	0.0

The 1967 production year aircraft accounted for about 55% of all serial numbers removed from the inventory. Also, it should be noted that both 1966 and 1967 production year aircraft had about 1/3 of their total inventory removed.

Table 2 shows the serial number and planned delivery month and year of AH-1G aircraft yet to be delivered.

TABLE 1 PAGE 1 OF 6

SERIAL NUMBERS OF ALL AH-1G AIRCRAFT WHICH HAVE ENTERED THE ARMY INVENTORY AND PRESENT STATUS

SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS
6615246	OUT	6615293	IN	6615325	IN	6715451	OUT	6715484	OUT
6615247	IN	6615294	OUT	6615326	OUT	6715452	IN	6715485	IN
6615248	IN	6615295	IN	6615327	IN	6715453	OUT	6715486	IN
6615250	IN	6615296	IN	6615328	IN	6715454	OUT	6715487	IN
6615251	IN	6615297	IN	6615329	OUT	6715455	IN	6715488	IN
6615255	IN	6615298	IN	6615330	IN	6715456	IN	6715489	IN
6615256	OUT	6615299	IN	6615331	IN	6715457	IN	6715490	IN
6615257	IN	6615300	IN	6615332	OUT	6715458	OUT	6715491	IN
6615258	IN	6615301	OUT	6615333	OUT	6715459	IN	6715492	IN
6615259	IN	6615302	IN	6615334	OUT	6715460	IN	6715493	OUT
6615260	OUT	6615304	IN	6615336	IN	6715461	OUT	6715494	IN
6615261	IN	6615305	OUT	6615337	OUT	6715462	IN	6715495	IN
6615262	IN	6615306	IN	6615338	IN	6715463	IN	6715496	IN
6615263	IN	6615307	IN	6615339	IN	6715464	OUT	6715497	IN
6615264	IN	6615308	OUT	6615340	OUT	6715465	IN	6715500	OUT
6615265	OUT	6615309	IN	6615341	IN	6715466	OUT	6715501	OUT
6615267	OUT	6615310	OUT	6615342	IN	6715467	IN	6715502	IN
6615269	OUT	6615311	OUT	6615343	IN	6715468	OUT	6715503	IN
6615271	IN	6615312	IN	6615344	IN	6715469	IN	6715504	IN
6615272	OUT	6615313	IN	6615345	IN	6715472	IN	6715505	IN
6615273	IN	6615314	OUT	6615346	IN	6715474	IN	6715506	IN
6615274	OUT	6615316	IN	6615347	OUT	6715475	IN	6715507	IN
6615275	IN	6615317	IN	6615348	IN	6715476	IN	6715508	IN
6615276	OUT	6615318	IN	6615349	OUT	6715477	IN	6715509	IN
6615277	IN	6615319	IN	6615350	IN	6715478	OUT	6715510	IN
6615283	IN	6615320	OUT	6615351	OUT	6715479	IN	6715511	IN
6615284	IN	6615321	IN	6615352	IN	6715480	IN	6715512	IN
6615285	IN	6615322	IN	6615353	IN	6715481	IN	6715513	IN
6615287	OUT	6615323	OUT	6615354	IN	6715482	IN	6715514	OUT
6615292	IN	6615324	IN	6615355	IN	6715483	IN	6715515	OUT

TABLE 1 PAGE 2 OF 6

SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS
6715516	IN	6715551	IN	6715586	IN	6715622	IN	6715662	IN
6715517	OUT	6715552	OUT	6715587	IN	6715624	IN	6715663	IN
6715518	OUT	6715553	IN	6715588	OUT	6715625	OUT	6715664	IN
6715519	OUT	6715554	OUT	6715589	IN	6715626	IN	6715665	IN
6715520	IN	6715555	IN	6715590	IN	6715627	IN	6715666	IN
6715521	IN	6715556	OUT	6715591	OUT	6715628	IN	6715667	OUT
6715522	IN	6715557	OUT	6715592	OUT	6715629	IN	6715668	IN
6715523	IN	6715558	OUT	6715593	IN	6715630	IN	6715669	IN
6715524	IN	6715559	OUT	6715594	IN	6715631	OUT	6715670	IN
6715525	OUT	6715560	IN	6715595	IN	6715632	OUT	6715671	OUT
6715526	OUT	6715561	OUT	6715596	OUT	6715633	IN	6715672	OUT
6715527	OUT	6715562	IN	6715597	OUT	6715634	OUT	6715673	IN
6715528	IN	6715563	IN	6715598	OUT	6715635	OUT	6715674	OUT
6715529	OUT	6715564	IN	6715599	IN	6715636	OUT	6715675	OUT
6715530	IN	6715565	IN	6715600	IN	6715637	OUT	6715676	IN
6715531	IN	6715566	OUT	6715601	IN	6715638	OUT	6715677	OUT
6715532	IN	6715567	IN	6715602	OUT	6715639	IN	6715678	OUT
6715533	IN	6715568	IN	6715603	IN	6715640	IN	6715679	IN
6715534	IN	6715569	OUT	6715604	OUT	6715641	IN	6715680	IN
6715535	IN	6715570	IN	6715605	OUT	6715643	IN	6715681	IN
6715536	IN	6715571	IN	6715606	IN	6715644	OUT	6715682	IN
6715537	IN	6715572	IN	6715607	IN	6715645	IN	6715683	IN
6715538	OUT	6715573	OUT	6715608	IN	6715646	IN	6715684	IN
6715539	OUT	6715574	IN	6715609	OUT	6715647	IN	6715685	IN
6715540	IN	6715575	OUT	6715610	IN	6715648	IN	6715686	OUT
6715541	IN	6715576	OUT	6715611	IN	6715649	IN	6715687	IN
6715542	IN	6715577	IN	6715612	OUT	6715650	IN	6715688	IN
6715543	IN	6715578	IN	6715614	IN	6715651	OUT	6715689	IN
6715544	IN	6715579	OUT	6715615	OUT	6715652	IN	6715690	IN
6715545	OUT	6715580	OUT	6715616	IN	6715653	IN	6715691	IN
6715546	IN	6715581	OUT	6715617	IN	6715654	IN	6715692	IN
6715547	IN	6715582	OUT	6715618	IN	6715655	IN	6715693	IN
6715548	IN	6715583	OUT	6715619	IN	6715656	IN	6715694	OUT
6715549	IN	6715584	OUT	6715620	OUT	6715657	IN	6715695	OUT
6715550	IN	6715585	OUT	6715621	IN	6715660	IN	6715696	OUT

TABLE 1 PAGE 3 OF 6

SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS
6715697	IN	6715732	IN	6715768	IN	6715803	IN	6715838	IN
6715698	OUT	6715733	OUT	6715769	IN	6715804	IN	6715839	OUT
6715699	OUT	6715734	OUT	6715770	OUT	6715805	IN	6715840	IN
6715700	IN	6715735	OUT	6715771	IN	6715806	OUT	6715841	IN
6715701	IN	6715736	IN	6715772	IN	6715807	OUT	6715842	IN
6715702	IN	6715737	IN	6715773	IN	6715808	IN	6715843	IN
6715703	IN	6715738	IN	6715774	IN	6715809	IN	6715844	IN
6715704	OUT	6715739	OUT	6715775	IN	6715810	IN	6715845	OUT
6715705	IN	6715740	IN	6715776	IN	6715811	IN	6715846	OUT
6715706	OUT	6715742	IN	6715777	IN	6715812	OUT	6715847	OUT
6715707	OUT	6715743	OUT	6715778	OUT	6715813	IN	6715848	OUT
6715708	IN	6715744	IN	6715779	OUT	6715814	OUT	6715849	OUT
6715709	OUT	6715745	IN	6715780	OUT	6715815	IN	6715850	OUT
6715710	IN	6715746	OUT	6715781	IN	6715816	OUT	6715851	IN
6715711	OUT	6715747	IN	6715782	IN	6715817	IN	6715852	IN
6715712	OUT	6715748	OUT	6715783	OUT	6715818	OUT	6715853	OUT
6715713	OUT	6715749	IN	6715784	IN	6715819	IN	6715854	IN
6715714	IN	6715750	IN	6715785	IN	6715820	OUT	6715855	IN
6715715	IN	6715751	OUT	6715786	OUT	6715821	OUT	6715856	IN
6715716	IN	6715752	OUT	6715787	IN	6715822	IN	6715857	IN
6715717	IN	6715753	OUT	6715788	OUT	6715823	IN	6715858	OUT
6715718	IN	6715754	IN	6715789	IN	6715824	IN	6715859	IN
6715719	OUT	6715755	OUT	6715790	IN	6715825	IN	6715860	IN
6715720	IN	6715756	OUT	6715791	IN	6715826	IN	6715861	OUT
6715721	IN	6715757	IN	6715792	IN	6715827	IN	6715862	OUT
6715722	IN	6715758	IN	6715793	OUT	6715828	IN	6715863	IN
6715723	OUT	6715759	IN	6715794	IN	6715829	IN	6715864	OUT
6715724	IN	6715760	OUT	6715795	IN	6715830	IN	6715865	IN
6715725	IN	6715761	IN	6715796	IN	6715831	IN	6715866	IN
6715726	IN	6715762	IN	6715797	IN	6715832	OUT	6715867	IN
6715727	IN	6715763	OUT	6715798	OUT	6715833	IN	6715868	OUT
6715728	OUT	6715764	IN	6715799	OUT	6715834	IN	6715869	IN
6715729	IN	6715765	OUT	6715800	IN	6715835	OUT	6815000	IN
6715730	IN	6715766	IN	6715801	IN	6715836	IN	6815001	IN
6715731	IN	6715767	IN	6715802	OUT	6715837	IN	6815002	OUT

TABLE 1 PAGE 4 OF 6

SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS
6815003	IN	6815035	IN	6815074	IN	6815111	OUT	6815147	IN
6815004	OUT	6815036	IN	6815075	OUT	6815114	OUT	6815148	IN
6815005	OUT	6815040	IN	6815076	IN	6815115	IN	6815149	IN
6815006	OUT	6815041	OUT	6815077	OUT	6815116	IN	6815150	OUT
6815007	IN	6815042	IN	6815078	OUT	6815117	IN	6815151	IN
6815008	OUT	6815043	OUT	6815081	IN	6815118	IN	6815152	IN
6815009	IN	6815044	OUT	6815082	OUT	6815119	OUT	6815153	IN
6815010	OUT	6815047	IN	6815083	IN	6815120	OUT	6815154	OUT
6815011	IN	6815048	IN	6815084	IN	6815121	OUT	6815155	IN
6815012	IN	6815049	IN	6815086	IN	6815122	IN	6815156	IN
6815013	IN	6815050	OUT	6815087	OUT	6815123	IN	6815157	IN
6815014	IN	6815051	IN	6815088	IN	6815124	OUT	6815158	IN
6815015	IN	6815052	IN	6815089	IN	6815125	OUT	6815159	IN
6815016	IN	6815053	IN	6815090	IN	6815126	IN	6815160	IN
6815017	IN	6815054	IN	6815091	IN	6815127	IN	6815161	OUT
6815018	IN	6815055	IN	6815092	IN	6815128	IN	6815162	OUT
6815019	OUT	6815056	OUT	6815093	IN	6815129	IN	6815163	IN
6815020	OUT	6815057	IN	6815094	IN	6815130	IN	6815164	IN
6815021	IN	6815058	IN	6815095	IN	6815131	IN	6815165	IN
6815022	IN	6815059	OUT	6815096	IN	6815132	OUT	6815167	IN
6815023	IN	6815060	OUT	6815097	IN	6815133	IN	6815168	OUT
6815024	OUT	6815061	OUT	6815098	OUT	6815135	IN	6815169	IN
6815025	OUT	6815062	OUT	6815099	OUT	6815136	OUT	6815171	OUT
6815026	OUT	6815063	IN	6815100	IN	6815137	OUT	6815172	IN
6815027	IN	6815064	IN	6815101	IN	6815138	IN	6815173	IN
6815028	IN	6815065	OUT	6815102	IN	6815139	IN	6815174	IN
6815029	IN	6815066	IN	6815103	IN	6815141	OUT	6815175	OUT
6815030	IN	6815067	IN	6815106	IN	6815142	IN	6815177	IN
6815031	IN	6815068	IN	6815107	OUT	6815143	IN	6815178	IN
6815032	OUT	6815069	IN	6815108	OUT	6815144	IN	6815179	IN
6815033	OUT	6815070	OUT	6815109	OUT	6815145	OUT	6815180	IN
6815034	OUT	6815071	IN	6815110	IN	6815146	IN	6815181	IN

TABLE 1 PAGE 5 OF 6

SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS
6815182	IN	6817028	IN	6817064	IN	6817102	OUT	6916432	IN
6815183	IN	6817029	OUT	6817065	IN	6817103	IN	6916433	IN
6815184	OUT	6817030	OUT	6817067	IN	6817104	IN	6916434	IN
6815185	OUT	6817031	IN	6817068	IN	6817106	OUT	6916435	IN
6815186	IN	6817032	OUT	6817069	IN	6817107	IN	6916436	IN
6815187	OUT	6817033	IN	6817071	IN	6817109	IN	6916437	IN
6815188	OUT	6817034	IN	6817072	IN	6817110	OUT	6916438	OUT
6815189	IN	6817035	OUT	6817073	OUT	6817111	IN	6916439	IN
6815191	IN	6817036	IN	6817074	IN	6817112	IN	6916440	IN
6815192	IN	6817037	IN	6817075	OUT	6817113	IN	6916441	IN
6815193	OUT	6817038	OUT	6817076	IN	6916410	IN	6916442	IN
6815195	IN	6817039	OUT	6817077	IN	6916411	IN	6916443	IN
6815196	IN	6817040	IN	6817078	IN	6916412	IN	6916444	IN
6815197	IN	6817042	IN	6817079	IN	6916413	IN	6916445	IN
6815199	OUT	6817043	IN	6817080	IN	6916414	OUT	6916446	IN
6815200	IN	6817044	IN	6817081	OUT	6916415	IN	6916447	IN
6815201	IN	6817046	IN	6817083	OUT	6916416	IN	701 5936	IN
6815202	IN	6817047	IN	6817084	IN	6916417	IN	701 5937	IN
6815203	IN	6817048	IN	6817085	IN	6916418	OUT	701 5938	IN
6815204	IN	6817050	OUT	6817087	IN	6916419	OUT	701 5939	IN
6815205	IN	6817051	IN	6817088	IN	6916420	IN	701 5940	IN
6815206	IN	6817052	IN	6817089	OUT	6916421	OUT	701 5941	IN
6815207	IN	6817053	IN	6817091	IN	6916422	IN	701 5942	IN
6815208	IN	6817054	IN	6817092	IN	6916423	IN	701 5943	IN
6815209	IN	6817055	IN	6817093	IN	6916424	IN	701 5944	IN
6815210	IN	6817056	IN	6817094	OUT	6916425	IN	701 5945	IN
6815211	OUT	6817057	OUT	6817095	IN	6916426	OUT	701 5946	IN
6815212	IN	6817058	IN	6817096	IN	6916427	IN	701 5947	IN
6817022	IN	6817059	OUT	6817097	OUT	6916428	IN	701 5948	IN
6817024	IN	6817060	IN	6817098	IN	6916429	IN	701 5949	IN
6817025	IN	6817061	IN	6817099	IN	6916430	IN	701 5950	IN
6817026	IN	6817063	IN	6817100	IN	6916431	IN	701 5951	IN

TABLE 1 PAGE 6 OF 6

SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS	SERIAL NUMBERS	INVENTORY STATUS
7015952	IN	7015984	IN	7016017	IN
7015953	IN	7015985	IN	7016019	IN
7015954	IN	7015986	IN	7016020	IN
7015955	IN	7015987	IN	7016021	IN
7015956	IN	7015988	IN	7016022	IN
7015957	IN	7015989	IN	7016023	IN
7015958	IN	7015990	IN	7016024	IN
7015959	IN	7015991	IN		
7015960	IN	7015992	IN		
7015961	IN	7015993	IN		
7015962	IN	7015994	IN		
7015963	IN	7015995	IN		
7015964	IN	7015996	IN		
7015965	IN	7015997	IN		
7015966	IN	7015998	IN		
7015967	IN	7015999	IN		
7015968	IN	7016000	IN		
7015969	IN	7016001	IN		
7015970	IN	7016002	IN		
7015971	IN	7016003	IN		
7015972	IN	7016004	IN		
7015973	IN	7016005	IN		
7015974	IN	7016006	IN		
7015975	IN	7016007	IN		
7015976	IN	7016008	IN		
7015977	IN	7016009	IN		
7015978	IN	7016010	IN		
7015979	IN	7016011	IN		
7015980	IN	7016012	IN		
7015981	IN	7016013	IN		
7015982	IN	7016014	IN		
7015983	IN	7016016	IN		

TABLE 2

SERIAL NUMBERS OF AH-1G

AIRCRAFT YET TO BE DELIVERED

MONTH	YEAR	SERIAL NUMBERS
APRIL	1972	7016015, 7016018, 7016025, THRU 7016037
MAY	1972	7016038 THRU 7016052
JUNE	1972	7016053 THRU 7016067
JULY	1972	7016068 THRU 7016082
AUGUST	1972	7016083 THRU 7016093
SEPTEMBER	1972	7016094 THRU 7016105
		7120983 THRU 7120985
OCTOBER	1972	7120986 THRU 7121000
NOVEMBER	1972	7121001 THRU 7121015
DECEMBER	1972	7121016 THRU 7121030
JANUARY	1973	7121031 THRU 7121041
FEBRUARY	1973	7121042 THRU 7121052

SIGNIFICANT OBSERVATIONS:

1. A total of 892 AH-1G aircraft have been accepted by the Army to date.

2. Two hundred and fifty-four AH-1G aircraft have been removed from the Army inventory for various reasons leaving a net fleet of 638 aircraft.

3. On the average, an aircraft of the fleet has accrued 1502 flight hours.

4. Fifty percent of the fleet has accrued between 689 and 1939 flight hours.

5. On the average, an aircraft of the fleet is 39 months (1170 days) old.

6. Fifty percent of the fleet is between 29 months (870 days) and 46 months (1380 days) old.

7. A total of 151 AH-1G aircraft are scheduled to be delivered to the Army during the period second quarter of CY 1972 and the first quarter of CY 1973.

AIRCRAFT MISSION ASSIGNMENT AND FREQUENCIES

The data gathered to present this chapter was taken from the Aircraft Operational Utilization (AOPU) report which used the Aircraft Inventory Status and Flying Time Data File and in conjunction with detailed RAMMIT Reports. The basic design is to furnish information on those factors which influence the assignment of the AH-1G aircraft toward mission accomplishment. Factors such as, the present mission assignment or lack of assignments, frequency and length of flights for accomplishing missions, and factors influencing availability of aircraft for mission success directly or indirectly measure the degree of assignment and utilization of Army aircraft. A knowledge of the effective relationship which these factors have on aircraft assignment will ultimately dictate material needs and systems requirements toward mission accomplishment.

A fleet of aircraft is procured for a certain mission as previously noted. Aircraft, as with other equipment, go through an assignment cycle as follows:

a. A period of being accepted by the buyer (awaiting delivery) or (serviceable storage).

b. A period of being moved to the place of utilization if new or to and from overhaul if used (in transit).

c. A period of being utilized (combat), (combat support), (indirect support), (flight training), (technical operations and maintenance training), (training support aircraft), (test aircraft) or (test support aircraft).

d. They are loaned for various reasons (loaned), (bailment), (maintenance float) and (theatre reserve).

e. If they require overhaul or have been in a crash and an estimate is required (awaiting disposition).

f. They are at depot for overhaul, battle or crash damage repair (at depot maintenance).

g. They are awaiting salvage because their useful life has been realized or were damage beyond economical repair (awaiting disposal).

h. There must be personnel available capable of repairing them when they become inoperable (category A, B, and C maintenance trainers).

The only time the aircraft are performing their designed mission is when they are being utilized as in (C) above. The other assignments are normal assignments of a piece of equipment. That portion of the fleet performing missions as in (C) above will be referred to as the percentage of the fleet operationally assigned.

The entire fleet should be available for flight mission assignments to the greatest extent practicable. The actual assignment of this fleet of aircraft during the period 01 April 1971 through 31 March 1972 is reflected in Illustration 1. Of the average quantity of aircraft (589) in the inventory during the period 01 Apr 71 thru 31 March 72, 74.5% (439 aircraft) were operationally assigned as opposed to 25.5% (150 aircraft) which were not operationally assigned.

Illustrations 2 and 3 present breakouts of operationally and not operationally assigned aircraft categories respectively for the period 01 Apr 67 thru 31 March 72. The major contributor of the operationally assigned categories is combat mission representing about 65% of the fleet. The Flight Training category experienced a peak in the 4th Quarter of 1967 & begin a steady decline through the 4th Quarter of 1970 where it tends to level off for the remaining periods.

With respect to the not operationally assigned aircraft, on the average 8% of the fleet were assigned to depot maintenance, and 4.1% of the fleet were awaiting disposition. Those awaiting delivery were 4% of the fleet over the 20 quarter period. The trend shows that aircraft awaiting delivery peaked in the 4th quarter of 1967 with a high of over 1/3 of the not operational aircraft.

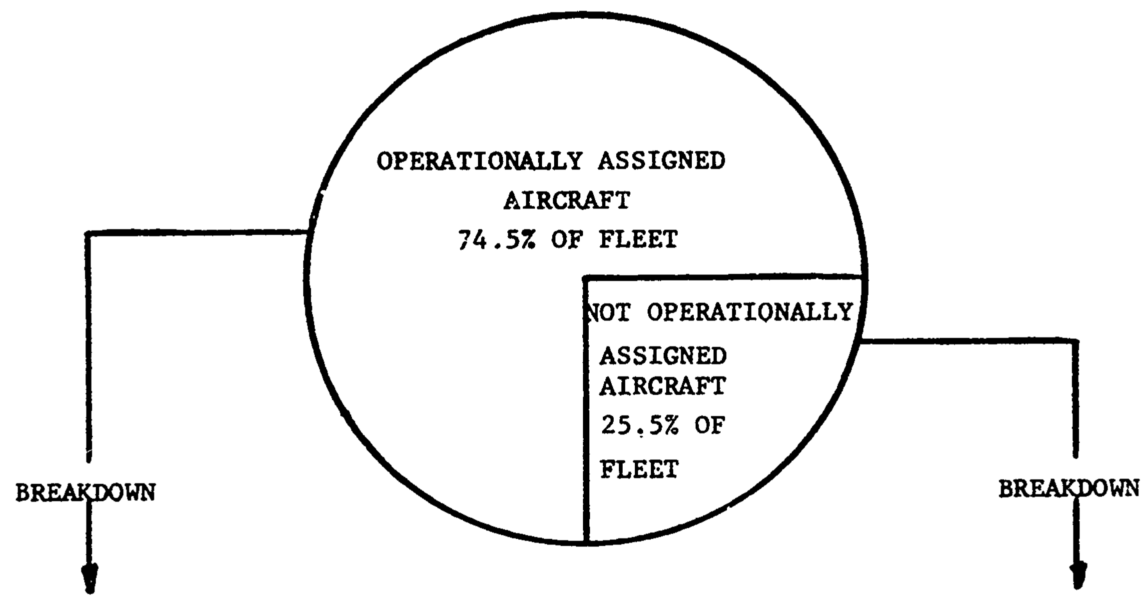
The trend of the average length of a flight for the period of 01 Apr 1967 thru 31 Mar 1972 is presented in Illustration 4, and should be considered in future procurement contracts and flight test programs. For the 20 quarter period the trend indicates an increase through the 3rd quarter of 1969 where it tends to level off and finally decreases after the 1st quarter 70. Additionally, the average number of flight per aircraft per month (112.6) and its trend is shown in the same illustration. Here the trend shows a decrease in the beginning quarters through CY 1968 where it levels off for 6 quarters, then continues to decrease through the first quarter of 1972.

The significance of these parameters is more fully exploited in connection with environmental effects. The greater the number of take-offs and landings, the greater the probability of foreign object damage and similar failure modes induced by the environment. The full impact of foreign object damage is paramount when analyzed in relation to engine failure and rotor blade failures.

ILLUSTRATION 1

AH-1G FLEET ASSIGNMENT OF AIRCRAFT

FOR PERIOD 01 APR 1971 THRU 31 MARCH 1972

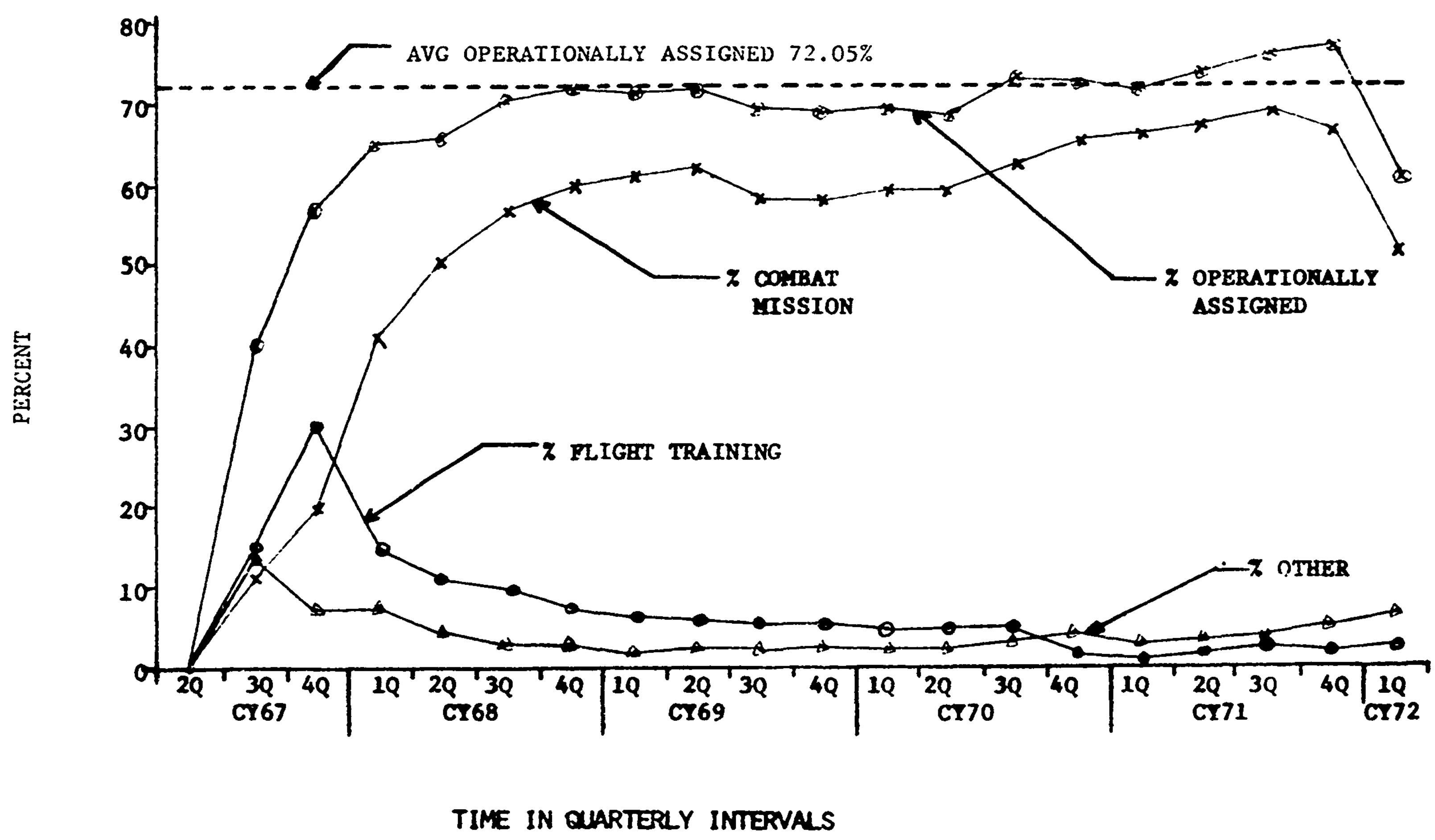


COMBAT MISSION	65.2% OF FLEET
FLIGHT TRAINING	3.0
TEST SUPPORT ACFT	3.1
OTHER	3.2
	74.5%

DEPOT MAINTENANCE	8.2% OF FLEET
GROUND MAINTENANCE TRAINER	2.9
AWAITING DELIVERY	2.6
MAINTENANCE FLOAT	2.0
IN TRANSIT	3.8
AWAITING DISPOSITION	3.7
OTHER	2.3
	25.5%

ILLUSTRATION 2

AH-1G FLEET OPERATIONALLY ASSIGNED AIRCRAFT CATEGORIES FOR PERIOD 01 APR 1967 THRU 31 MAR 1972



AH-1G FLEET

NOT OPERATIONALLY ASSIGNED AIRCRAFT TRENDS

FOR PERIOD 01 APR 1967 THRU 31 MARCH 1972

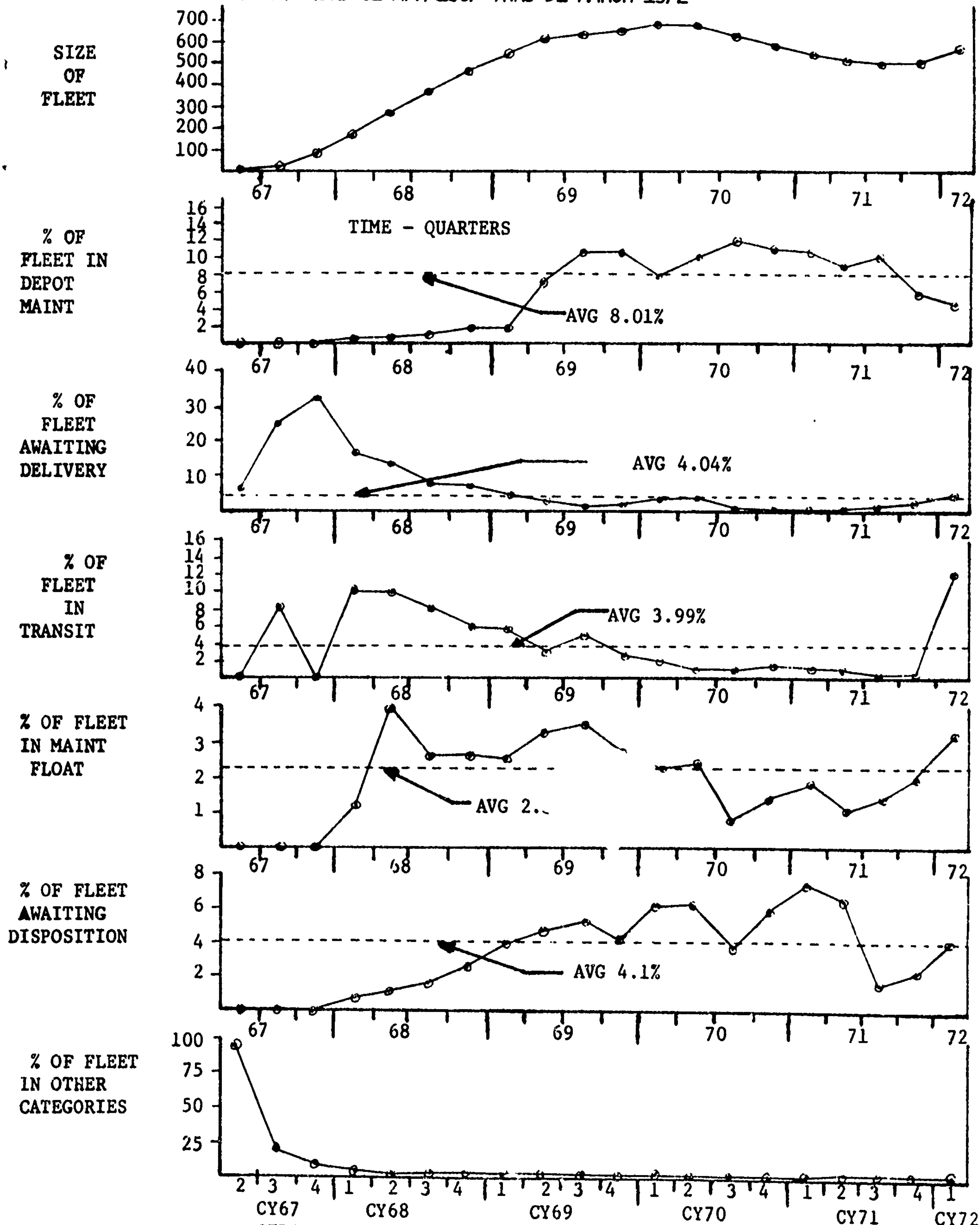


ILLUSTRATION 4

FLIGHTS PERFORMED FOR MISSION ACCOMPLISHMENT
FOR PERIOD 01 APR 1967 THRU 31 MAR 1972

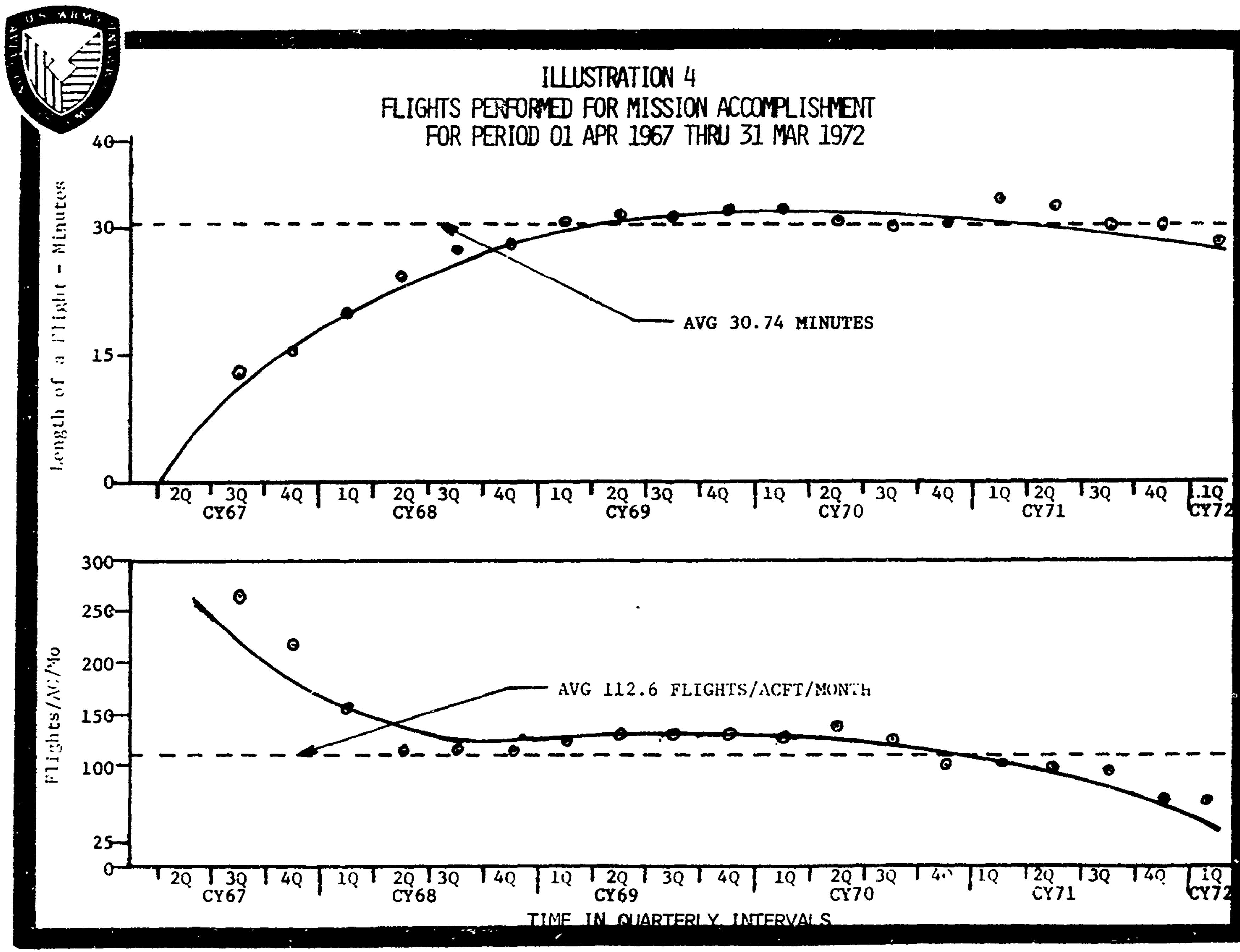
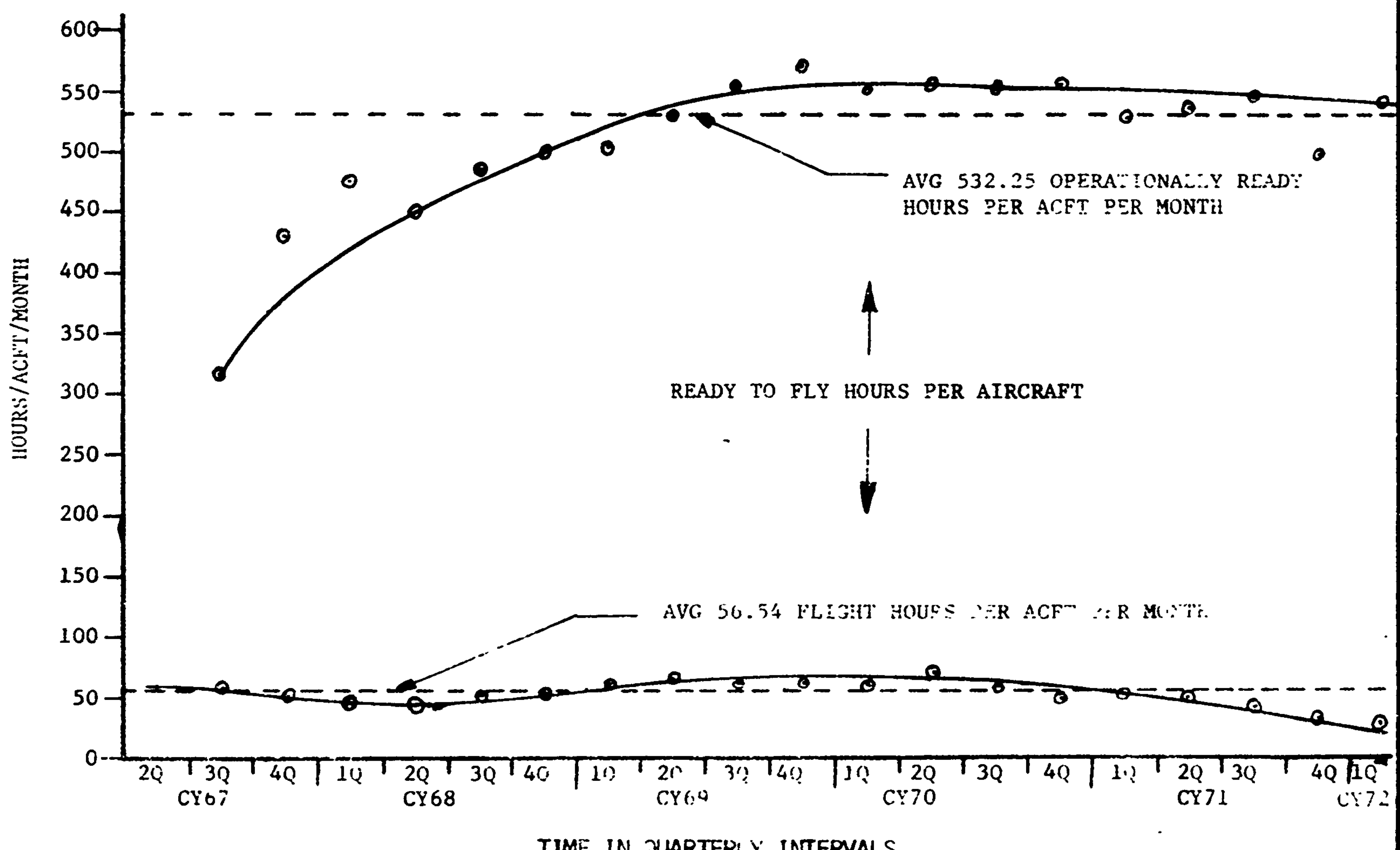


Illustration 5 presents the trends of the operationally ready hours per aircraft and the flight hours per aircraft (usage rate) for the period 01 April 1967 thru 31 March 1972. The average operationally ready hours/aircraft is noted as 532.3 for the 20 quarter period. There was an average of 56.5 flight hours per aircraft per month flown for the same period. There has been a constant decrease in usage rate (flight hours per aircraft) since the second quarter of CY 70.

The dispositioning and transferring of aircraft to meet mission requirements is primarily a result of the Army's response to meet military needs as the world situation dictates. However, the lack of available aircraft because of maintenance policies (cyclic overhaul) and also the need for maintenance while operationally assigned are frequently a result of less than optimum maintenance procedures, lack of qualified manpower resources, indicators of poor reliability and maintainability, and a less than efficient logistical system. Evaluations when warranted must be made on those systems, factors and procedures which have negative influence on mission accomplishment resulting in aircraft not operationally assigned and low operational readiness for those aircraft operationally assigned.

ILLUSTRATION 5

AH-1G FLEET HOURS PER AIRCRAFT PER MONTH
FOR PERIOD 01 APR 1967 THRU 31 MAR 1972



SIGNIFICANT OBSERVATIONS:

1. Operationally assigned aircraft (74.5% of the fleet) were flown 40.1 hours per month during the period 1 April 1971 through 31 March 1972.

2. The two major assignment categories of operationally assigned aircraft during the period 1 April 1967 through 31 March 1972 were combat mission and flight training.

3. The four major assignment categories of not operationally assigned aircraft during the period 1 April 1967 through 31 March 1972 were depot maintenance (8%), awaiting disposition (4.1%). awaiting delivery (4.0%), and in transit (4.0%).

4. The average operationally assigned aircraft made 112.6 flights per month of 30.7 minutes duration during the period 1 April 1967 through 31 March 1972.

5. The usage rate of an average AH-1G operationally assigned aircraft during the period 1 April 1967 through 31 March 1972 was 56.5 flight hours per aircraft per month.

FLEET AIRCRAFT OPERATIONAL READINESS (AVAILABILITY)

This chapter deals with the operational readiness (OR) of the AH-1G fleet.

Referring to Illustration 1, that portion of the fleet that was operationally assigned, was operationally ready 74.8% of the time (546.0 hours of a 730 hour month) during the period 1 April 1971 through 31 March 1972. An aircraft is considered operationally ready during daily inspections and by definition during all not operationally ready maintenance (NORM) time in which the aircraft can be made operationally ready within one hour. Time for refueling, crew change, preflight, runup, and pretake-off checks must also be subtracted from the OR time to obtain actual time available for flight.

A breakdown of the operationally ready and not operationally ready status is found in Illustration 1. Of the 546.0 operationally ready hours the aircraft were flown, 5.6% of the time, or 40.8 hours per month.

Theoretically, aircraft that are operationally assigned could be available for flying 100% of the time. However, the degree of consideration given to reliability and maintainability during design of an aircraft system, plus the efficiency of the logistics system after the aircraft enters the Army inventory, influence the potential of aircraft to reach this goal. Measures of operational readiness and the various stratifications provide a thermometer that shows the effects of influencing factors and provide indications as to significant contributions.

Not operationally ready maintenance (NORM) and not operationally ready supply (NORS) are measured in calendar hours. With the exceptions stated previously, NORM is a result of maintenance that must be performed and any elapsed time awaiting maintenance due to lack of facilities or personnel. However, NORM hours do not indicate what required the maintenance, why required, resources available for accomplishment and the efficiency with which the maintenance was performed. NORS is related to NORM in that during NORM the requirement for parts and material is established. If the parts or materials are not available when called for, the aircraft goes into NORS status until the parts or material are avilable. Therefore, the NORS rate indicates the ability of the supply system to furnish materials needed for accomplishing maintenance. During the last year OR has been better (74.8%) than the world wide standard (WWS), 74%. NORM total (NORM organization, direct and general support) has been better (18.2%) than the WWS, 21%. However, there have been supply problems in that NORS (7.0%) was 40% above the WWS, 5.0%.

ILLUSTRATION 1

AH-1G FLEET OPERATIONAL READINESS FOR AIRCRAFT OPERATIONALLY ASSIGNED

FOR PERIOD 1 APR 1971 THRU 31 MAR 1972

Hours on Hand
(730 Hours Per Average Month or 100% of Time)

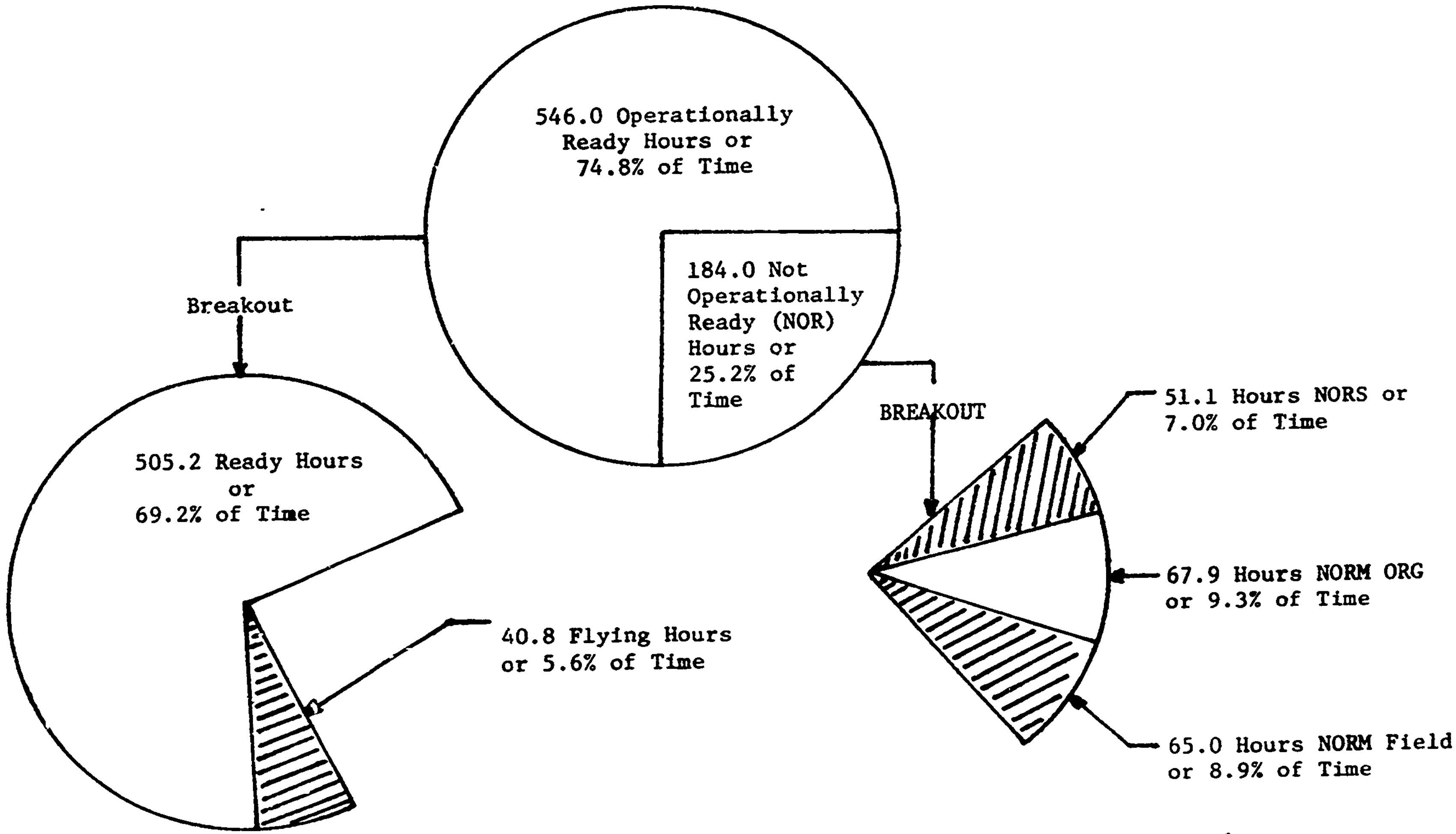


Illustration 2 presents the OR trends from the time AH-1G aircraft entered the Army inventory in March 1967 through 31 March 1972. The OR of the operationally assigned portion of the fleet has demonstrated a steadily increasing trend. There was a significant decrease in OR during the first quarter of calendar year (CY) 1971, however, another increasing trend has developed. A new WWS of 74% was established for the AH-1G in July of 1971. The operationally assigned portion of the fleet has met or surpassed this standard since it was established. The percent of time flown per quarter is also displayed on Illustration 2.

The not operationally ready trends are presented in Illustration 3. NORM total, the combination of NORM organization and direct and general support has had a steadily decreasing trend since it was first reported in the third quarter of CY 1967 until the fourth quarter of CY 1969. Since that time an increasing trend has developed except during the last two quarters of CY 1971 and the first quarter of CY 1972 during which a decreasing trend has developed. NORM organization follows approximately the same trend as NORM total. The trend of percent NORM field is provided in the bottom portion of Illustration 3. An overall decreasing trend is exhibited over the whole period. However, there was an increasing trend during CY 1970 and half of CY 1971. Returning to NORM total, it has been within its WWS of 21% since the new standard was established in July 1971. The average value over the five year period of 17.5%.

Trends of percent NORS for the whole life of the fleet are shown in Illustration 4. Although a generally decreasing trend of % NORS is demonstrated over the period, this fleet has failed to meet its WWS (5%) since the standard was established. An average NORS rate of 7.7% was demonstrated over the whole period.

An additional concept which should be considered is TRUE FLEET AVAILABILITY of the entire fleet inventory. Operational readiness (availability) is derived from that portion of the fleet operationally assigned. The data shows that 74.5% of the fleet was operationally assigned during the last year. Therefore, about 25.5% of the fleet is not included in a conventional operational readiness calculation. TRUE FLEET AVAILABILITY encompasses the operational readiness of the fleet in conjunction with that portion of the fleet which is operationally assigned and is calculated as follows: TRUE FLEET AVAILABILITY = THE PORTION OF THE FLEET OPERATIONALLY ASSIGNED TIMES THE PORTION OF THE FLEET OPERATIONALLY READY.

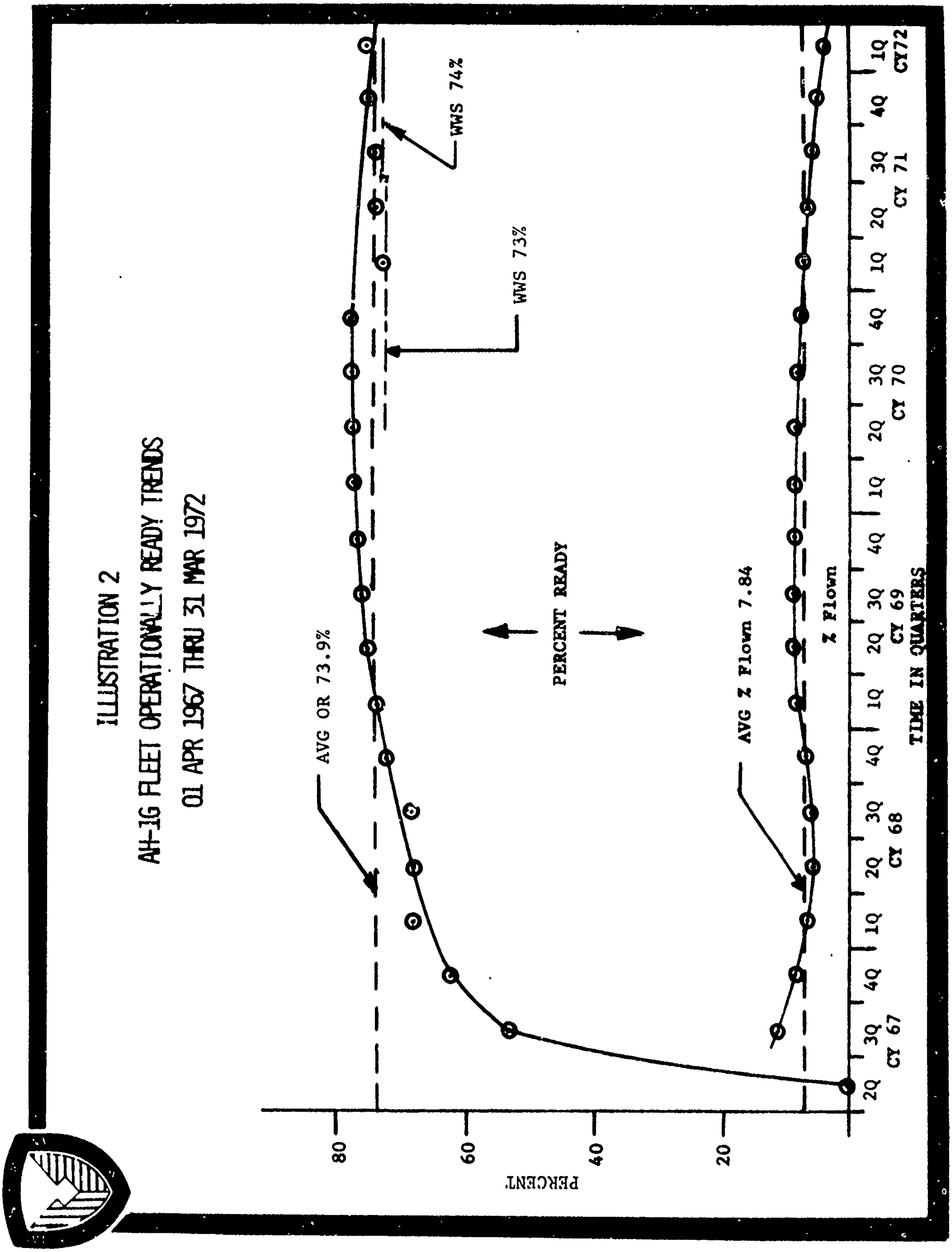


ILLUSTRATION 2
AH-1G FLEET OPERATIONALLY READY TRENDS
01 APR 1967 THRU 31 MAR 1972

ILLUSTRATION 3
AH-1G FLEET

NORM TRENDS

FOR PERIOD 01 APR 1967 THRU 31 MAR 1972

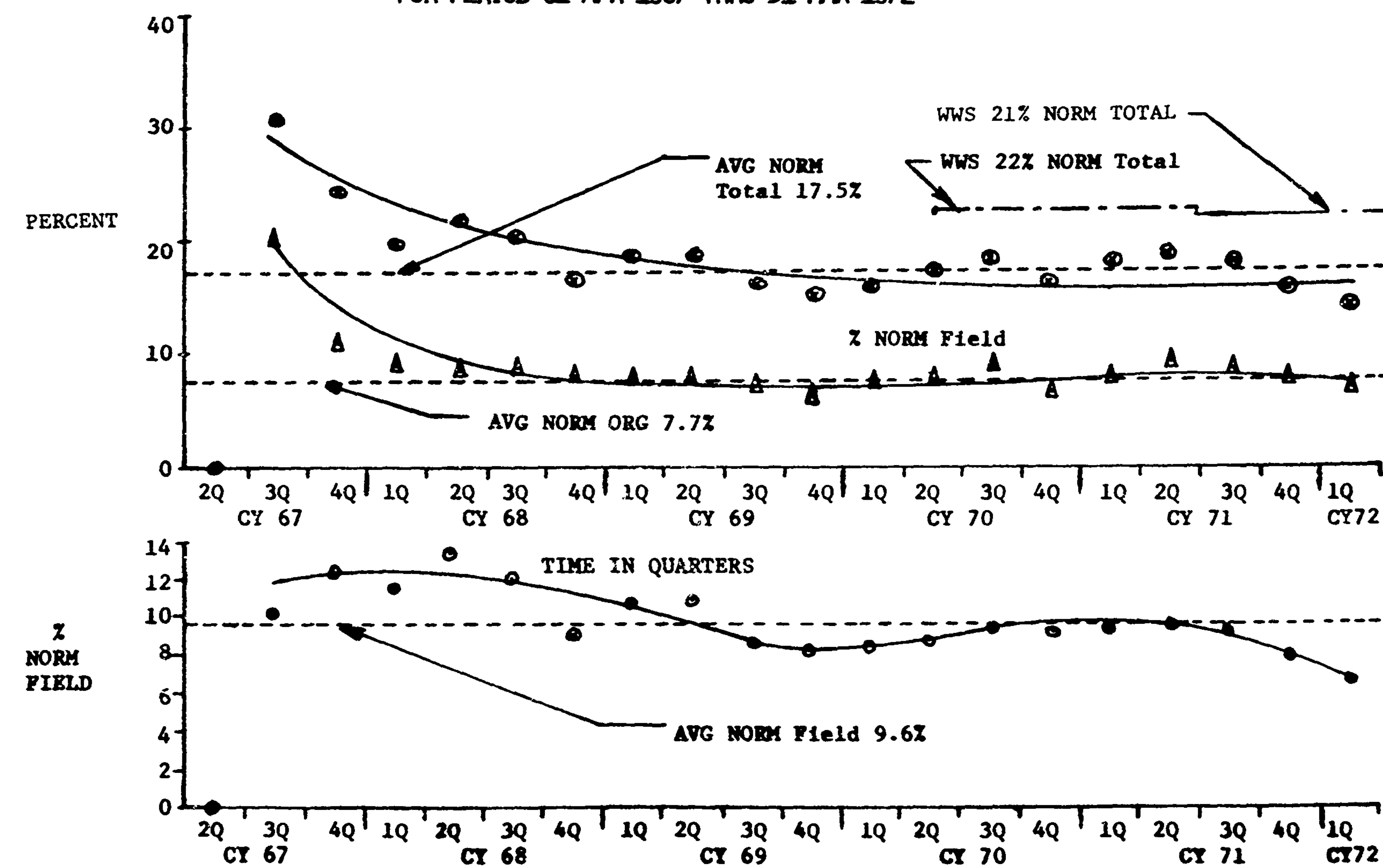


ILLUSTRATION 4

AH-1G FLEET NORS TREND

PERIOD 01 APR 1967 THRU 31 MAR 1972

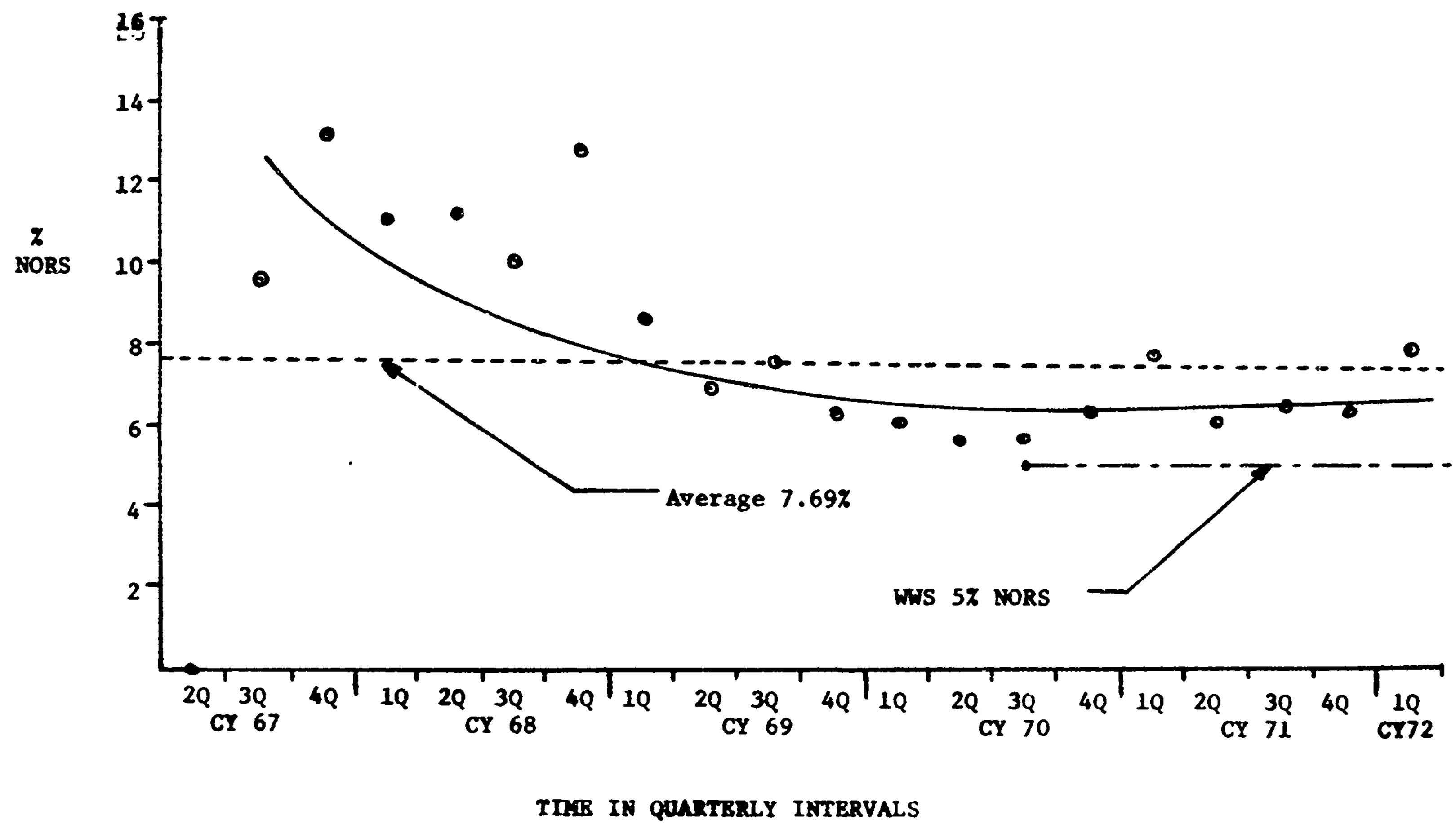
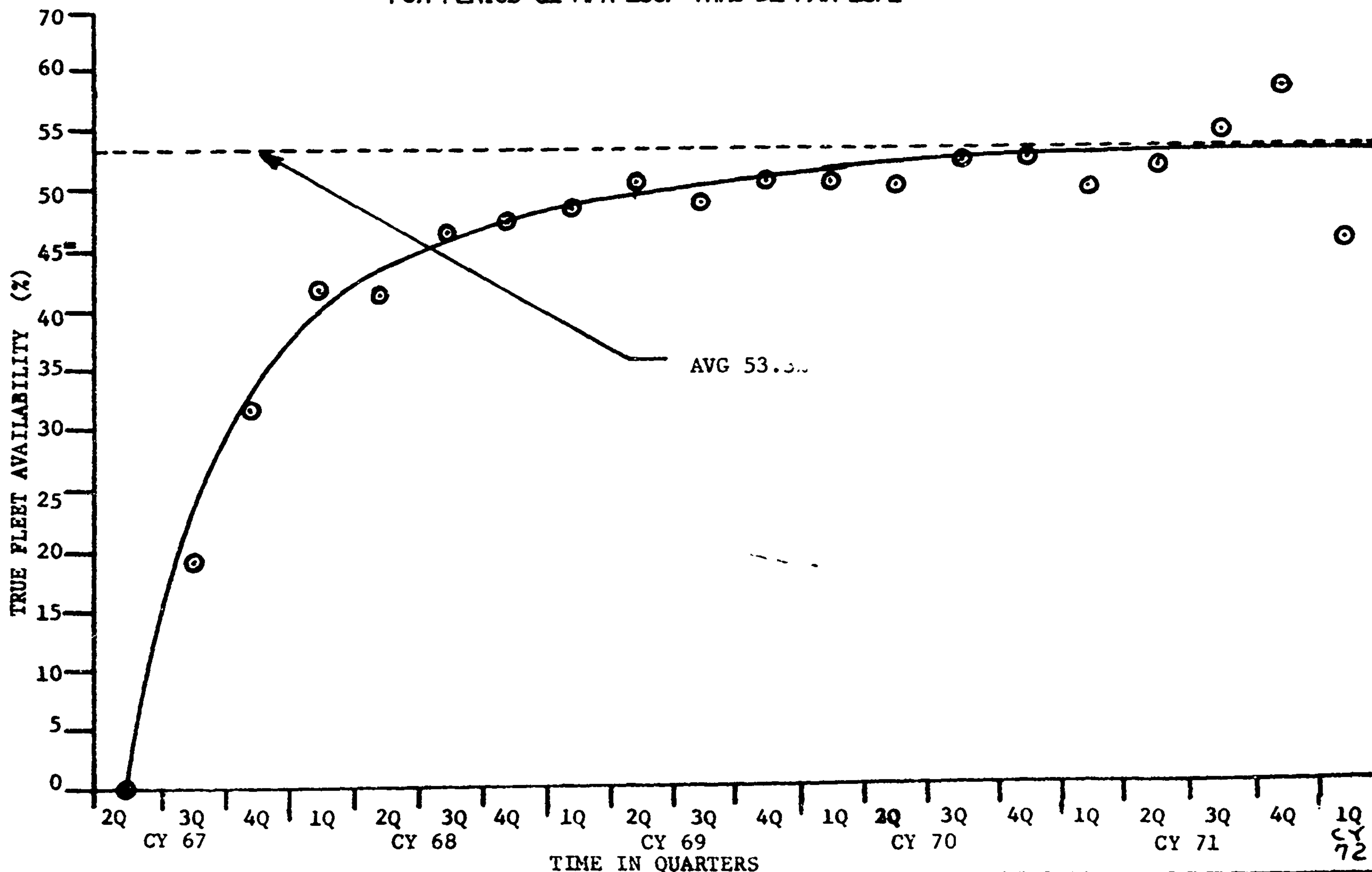


Illustration 5 displays the true fleet availability of all AH-1G aircraft from the second quarter of CY 1967 through the first quarter of CY 1972. The average for the 20 quarter period is 53.3% with an overall increasing trend.

ILLUSTRATION 5

AH-1G TRUE FLEET AVAILABILITY

FOR PERIOD 01 APR 1967 THRU 31 MAR 1972



SIGNIFICANT OBSERVATIONS

1. The trend of percent operational readiness of the fleet is increasing.

2. The fleet has met or surpassed its WWS (74%) for operational readiness since the standard was established in July 1971.

3. The trend of percent NORM total is decreasing. The trend of NORM organization is decreasing.

4. The fleet has met or surpassed its WWS (21%) for NORM total (organization and direct and general support) since the standard was established in July 1971.

5. The overall trend of percent NORS is decreasing. However, since the second quarter of CY 1970, it has been increasing.

6. The fleet has failed to meet its WWS (5.0%) for NORS since it was established in June 1970.

7. TRUE FLEET AVAILABILITY has averaged 53.3% over the twenty quarters this fleet has been in the Army inventory.

8. The trend of TRUE FLEET AVAILABILITY has exhibited a steady increase over the twenty quarters. However, in the first quarter of 1972 it has taken a significant drop primarily because of a significant drop in the portion of the fleet operationally assigned.

NEW AND OVERHAULED AIRCRAFT
ACCEPTANCE INSPECTION
BY USER

Manufacturers and overhaul facilities include a DA Form 3703-R, Product Quality Inspection Summary with the aircraft records when the aircraft is ready for shipment to the user. The Plant cognizant, or overhaul facility, completes Section A of the form and the user, or receiving activity, completes Section B. Illustration 1 is a copy of the DA Form 3703-R presently used. Ilustration 2 is proposed new DA Form 3703-R.

Section B shows the deficiencies found on the aircraft by the receiving agency which does the acceptance inspection in accordance with TB 55-1500-325-25, Aircraft Quality Summary, Acceptance Inspection.

This program was implemented in June 1970, and there is not a great amount of data available at the present time on the AH-1G fleet. The AH-1G is overhauled at ARADMAC and at Bell, Amarillo. New aircraft are built at Bell, Fort Worth. All data available on AH-1G's was grouped in order to get a better overview of the total quality picture. As more data becomes available, the quality of aircraft from each facility will be presented separately.

TB 55-1500-325-25 requires that a brief description of each safety-of-flight defect be given in Item 13, present form, with recommendations as appropriate. "Other" defects need not be itemized, but the number observed will be entered. Any defect found during the ferry flight will be treated in the same manner.

Results of a review of the data from June 70 through March 72 are shown in the table.

COMMENTS:

It is comtemplated that changes will soon be implemented in TB 55-1500-325-25 which will require the use of the DA Form 3703-R for major components. The form will also be changed to insure better traceability of problem areas in aircraft shipped to the user. The system will be designed for automatic data processing.

RECOMMENDATIONS:

It is recommended that when a safety-of-flight defect is reported that careful attention be given to a decision that it truly is a safety-of-flight defect. Some reported as such in the past were doubtful even to those not qualified to make such a decision. It is also recommended that the time required to repair, and to put the aircraft in flight status, be entered on all applicable DA Forms 3703-R.

PRODUCT QUALITY INSPECTION SUMMARY For use of this form, TB 55-1500-325-25, the proponent agency is the United States Army Materiel Command.			Exempt from Reports Control - Para 7-2e, AR 335-15
See instructions on reverse for completing form.			
SECTION A - MAINTENANCE PRODUCTION FACILITY			
1. NOMENCLATURE & SERIAL NUMBER	2. MANUFACTURE/MAINTENANCE FACILITY		3. TYPE WORK [ ] NEW [ ] OVERHAUL [ ] MOD [ ] REPAIR [ ] OTHER (Specify)
4. CONTRACT/DMWR NUMBER	5. GOVERNMENT INSPECTION AGENCY		6. DATE ACCEPTED
SECTION B - RECEIVING INSPECTION ACTIVITY			
7. INSPECTING ORGANIZATION	8. ORGANIZATION CODE		9. DATE RECEIVED / INSPECTED
10. CONDITION [ ] SATISFACTORY [ ] UNSATISFACTORY	11. NUMBER DEFECTS SAFETY FLIGHT	OTHER	12. ESTIMATED MAN-HOURS TO REPAIR
13. ITEMIZE SAFETY OF FLIGHT DISCREPANCIES/RECOMMENDATIONS			
DATE	SIGNATURE OF MAINTENANCE OFFICER		

DA FORM 3703-R, 1 Mar 71

Figure 1. Product Quality Inspection Summary (DA Form 3703-R)

PRODUCT QUALITY INSPECTION SUMMARY For use of this form TB 55-1500-325-25, the proponent agency is the US Army Material Command			Exempt from reports control para 7-2e AR 335-15
See instructions on reverse for completing form			(1) Serial Number
SECTION A Maintenance/Overhaul/Production Facility			
(2) Model Identification (5) Part/FSN (6) Contract/DMWR	(3) Facility		(4) Type Work ☐ New ☐ Overhaul ☐ Mod ☐ Rework ☐ Other (Specify)
(7) Government Insp. Agency	(8) Shipped to:		(9) Date Accepted (10) Hours on unit
SECTION B Receiving Activity			
(11) Inspecting Organization	(12) Unit Identification Code (UIC)		(13) Date Received / Inspected
(14) ☐ Adequate ☐ Inadequate	(15) Number of Defects Safety Flight	Other	(16) Estimated Man Hours to Repair
(17) Itemize Safety of Flight Items	(18) Part/FSN	(19) EIR Control No	(20) Def Code
(21) Other Defects			
(22) Recommendations			
Date	Signature of Maintenance Officer		

DA Form 3703-R

AH-1G
AIRCRAFT QUALITY SUMMARY ACCEPTANCE
JUNE 70 - MARCH 72

SAFETY-OF-FLIGHT DEFECTS	TOTAL	% TOTAL
LOOSE HARDWARE	21	24.7
IMPROPERLY SAFETIED	11	12.9
OIL LEAKS	9	10.7
LINES CHAFING	7	8.3
SYNC ELEV DEFECTS	3	3.5
AFT T/R CONTROL TENSION LOW	3	3.5
FUEL SYS DEFECTS	3	3.5
MISCELLANEOUS*	28	32.9
TOTAL	85	100.0

TOTAL REPORTS RECEIVED	116 (REPRESENTS 116 A/C)
AVERAGE SAFETY-OF-FLIGHT DEFECTS PER A/C	0.73
TOTAL "OTHER" DEFECTS	281 (AVG PER A/C - 2.42)
TOTAL A/C WITH NO DEFECTS REPORTED	41
NUMBER HOURS REPORTED TO REPAIR DEFECTS	639.2
AVERAGE HOURS PER A/C TO REPAIR	5.51

*MISCELLANEOUS COVERS 28 NON-REPETITIVE DEFECTS

FLIGHT SUCCESS

INTRODUCTION (U)

This chapter is a summary of information reported on Crash Fact Messages (CFMs) during the period 1 Jan 71 through 31 Mar 72. Operational aircraft are selected from two geographical areas, RVN and CONUS, to be included in the statistics presented in this chapter.

Mission success may be defined as the completion of a specified mission without an interruption caused by material or operational failures. Material failures are those in which some component or part is unable to withstand abnormal stress or environmental conditions. Operational failures may be attributed to human error or accidents not associated with material failures.

Flight aborts, a term used often in this chapter, means the mission was stopped or interrupted for any precautionary action or an actual failure of any kind.

Table 1 presents a summary of all CFM's during the report period tabulated by category and cause. Sixty-nine percent of all flight aborts were in the category of "Precautionary Landings." Nearly twenty-four percent of all flight aborts resulted from the cause "Warning Light Came On."

1 JAN 71 - 31 MAR 72

CAUSE	PREC. LANDING	INCIDENT	FORCED LANDING	MAJOR ACCIDENT	MINOR ACCIDENT	COMBAT DAMAGE	TOTAL LOSS	TOTALS BY CAUSE	% TOTAL FLIGHT ABORTS
	CATEGORY								
WARNING LIGHT CAME ON	82	2	3	1	0	0	0	88	23.78
OTHER	44	11	2	11	0	1	2	75	20.27
SUSPECT HYDRAULIC SYSTEM FAILURE	41	0	3	0	0	0	0	44	11.89
BROKEN OR LOOSE HYDRAULIC LINES	16	1	0	0	0	0	0	17	4.59
SUSPECT ENGINE FAILURE	11	1	6	3	0	0	1	22	5.95
LOSS OF RPM LOW RPM	4	0	3	3	0	0	0	10	2.70
LOSS OF POWER	4	0	0	1	0	0	0	5	1.35
STRUCK OBJECT	1	12	0	5	0	2	1	21	5.68
PILOT ERROR	0	1	0	4	0	0	0	5	1.35
SUSPECT CONTROL SYSTEM FAILURE	28	5	4	1	0	0	0	38	10.27
MAINTENANCE ERROR	7	5	0	0	1	0	0	13	3.51
SUSPECT GEAR BOX FAILURE	5	2	1	1	1	0	0	10	2.70
SUSPECT TAIL ROTOR FAILURE	4	1	2	2	1	0	1	11	2.97
SUSPECT ELECTRICAL SYSTEM FAILURE	9	0	0	0	0	0	0	9	2.43
LATE RECOVERY FROM AUTOROTATION	0	2	0	0	0	0	0	2	0.54
TOTALS BY CATEGORY	256	43	28	32	3	3	5	TOTAL NUMBER OF FLIGHT ABORTS FOR REPORT PERIOD 370	
% TOTAL FLT ABORTS	69.19	11.62	7.57	8.65	0.81	0.81	1.35		

Table 2 shows flight aborts by category in RVN and CONUS. Based on the average inventory in each area during the period 1 Jan 71 through 31 Mar 72 the number of aborts per aircraft in RVN was 0.80 and in CONUS the number per aircraft was 1.09.

The information in Tables 1 and 2 is derived from Crash Fact Message and DA Forms 1352. It is presented to help pinpoint problem areas that affect the mission success of the aircraft.

TABLE 2

FLIGHT ABORTS BY GEOGRAPHICAL AREA

1 JAN 71 - 31 MAR 72

CATEGORY	LOCATION	
	RVN	CONUS
Precautionary Landing	216	40
Incident	31	12
Major Accident	29	3
Forced Landing	23	5
Total Loss	4	1
Minor Accident	3	0
Combat Damage	3	0
TOTAL	309	61
% TOTAL FLIGHT ABORTS	83.5	16.5
FLIGHT ABORTS PER AIRCRAFT (Average Inventory For Reporting Period)	0.80	1.09

The information in Table 3 is presented so that comparisons between average flight durations and frequency of flight aborts can be made for the two locations. Values for the mean time between (MTB) flight aborts are also listed to aid in establishing possible correlations.

Number of Flights - Number of Landings Reported on DA Form 1352

Accrued Flight Hours - Total Flight Hours Reported on DA Form 1352

$$\text{Flight Durations (Minutes)} = \frac{\text{Accrued Flight Hours}}{\text{Number of Flights}} \times 60$$

$$\text{Flight Success, \%} = \left(1 - \frac{\text{Number of Flight Aborts}}{\text{Number of Flights}}\right) \times 100$$

$$\text{Mean Time Between Aborts} = \frac{\text{Accrued Flight Hours}}{\text{Number of Aborts}}$$

The MTB aborts for RVN aircraft was 3.2 times as great as for those flown in CONUS. This appears to be attributable to the use of CONUS aircraft for pilot check-out and familiarization.

FLIGHT SUCCESS (PERCENT)
AH-1G 1 JAN 71 - 31 MAR 72

STATISTIC	LOCATION		
	RVN	CONUS	TOTAL
Number of Flights	432510	44654	477164
Average Flight Duration (Minutes)	34.85	20.90	(AVG) 33.54
Number of Flight Aborts	309	61	370
Flight Success (Percent)	99.9285	99.8640	(AVG) 99.9225
Accrued Flight Hours	251189	15557	(AVG) 266746
MTB Flight Aborts (Flight Hours)	812.90	255.03	720.94

Table 4 is a listing of the number of flight aborts per aircraft by production year. Only operationally ready aircraft are considered in the calculations in this table.

Approximately 36 of the 1970 production year aircraft are in non-operational status as of the time covered by this report.

The 1966 production year aircraft indicated 95.63% of the 1966 inventory had flight aborts reported against them. The low of 6.25% was reported on the 1970 production year inventory.

There was no significant difference in the 1967, 1968, and 1969 models.

TABLE 2
Aborts by Production Year
by Qtr 1 Jan 71-31 Mar 72

	Production Year					
	66	67	68	69	70	TOTAL By Qtr
1st Qtr 1971 (CY)	4	44	28	6	0	82
2nd Qtr 1971	10	36	18	3	0	67
3rd Qtr 1971	7	54	37	4	1	103
4th Qtr 1971	6	33	21	1	0	61
1st Qtr 1972	8	29	16	1	3	57
Totals for Period	35	196	120	15	4	370

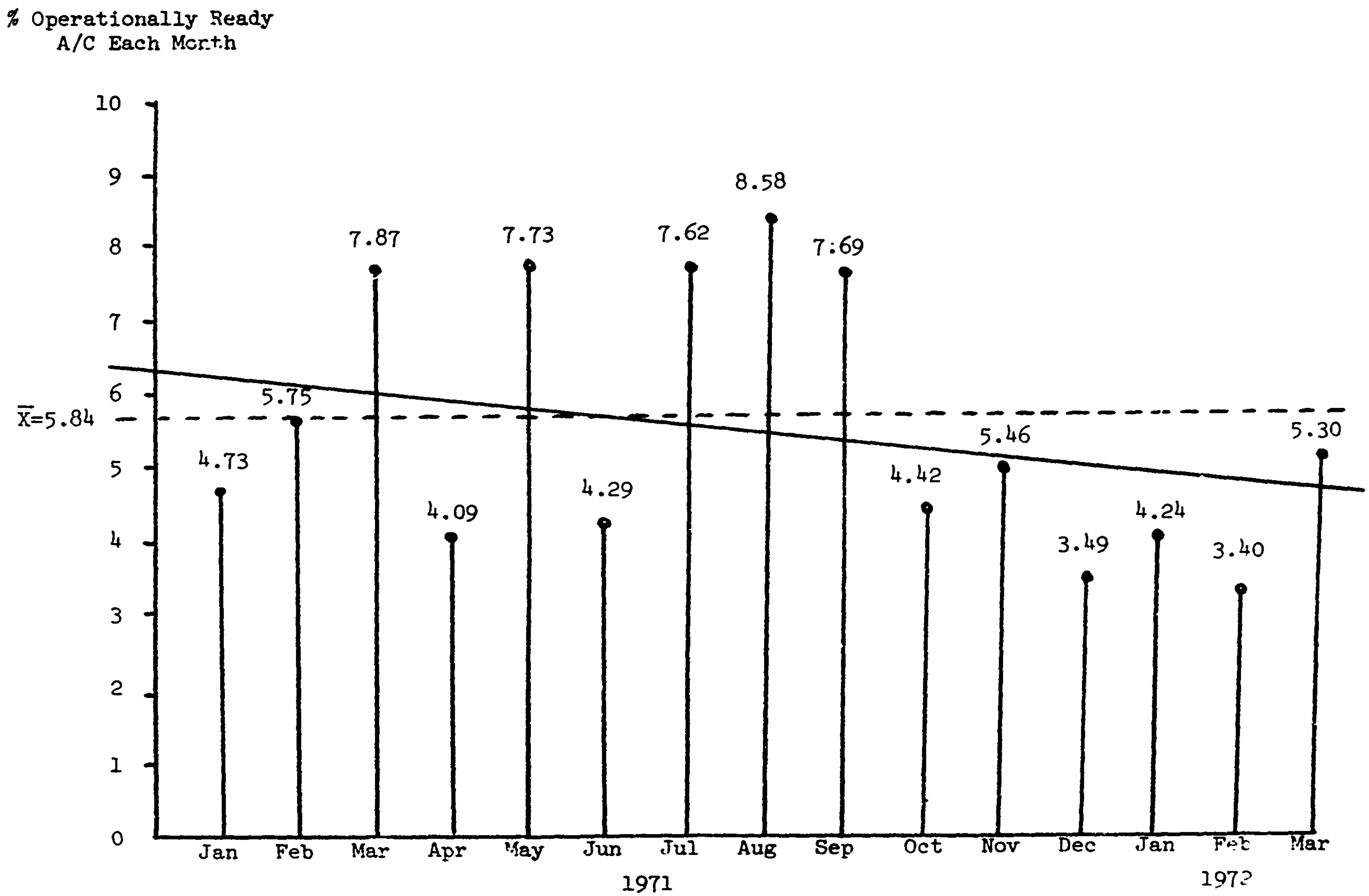
Note: Only the operationally ready portion of the total inventory considered here.

Illustration 1 shows a downward trend on a monthly basis of mission aborts as a percentage of the average monthly inventory of operationally ready (OR) aircraft.

This illustration depicts a mean rate of aborts of 5.84% of the average (OR) monthly inventory for the period. The least-squares trend line indicates the rate of aborts declined from 6.48% in Jan 1971 to 4.80% in Mar 1972. If this trend should continue with all conditions remaining essentially the same, by extrapolation, we can expect the flight abort rate to drop to 3.80% by the end of 1972. Least-squares trend lines are particularly influenced by extreme variations because of the squaring process, therefore, there can be no assurance that the rate will actually drop to 3.80%. Least-squares is an appropriate and convenient method of indicating trends when used judicially.

ILLUSTRATION 1

TREND OF ABORTS BY MONTH
PERCENT OF AVERAGE OPERATIONALLY
READY AIRCRAFT



SIGNIFICANT OBSERVATIONS

The trend of flight aborts based simply on a best-fit, least-square straight line showed a decrease during 1971. If this trend continues, it can be estimated that the mean rate of aborts will drop from a monthly mean rate of 6.48% of monthly inventory in 1971 to 3.80% in 1972.

Of the total of 370 aborts, 149 or 40.3% were directly attributable to system related causes. These are "hydraulic system, control system, engine failure, tail rotor, gear box, electrical system, oil system, fuel system, and main rotor" in descending order of frequency of occurrence. Of the remaining 221 aborts, 163 or 74% were for the "warning light came on" or "other" causes.

As to the categories of.aborts, "precautionary landing" accounted for 250 or 69% of the total. "Incident, major accident" and forced landing" were the categories assigned to an additional 103 aborts. The balance of 11 aborts were distributed among the remaining three categories.

The rate of aborts was significantly higher for production year 1966 aircraft than for 1967 through 1970.

Twenty-two flight aborts or 5.95% of the total were reported as suspected engine failures.

Approximately twenty-four percent of the aborts reported during the year were attributed to "warning light came on." The previously recommended field survey in this area should be continued in an effort to isolate malfunctions of the warning light system. Corrective action should be taken as necessary on the basis of the results of the survey.

Of the 149 flight aborts directly attributable to system oriented causes 82 or 22.2% were caused by suspected hydraulic or control system failures. An engineering survey of these area is recommended.

FLEET DEPOT RETURNS

1. Present Return Criteria:

a. The purpose of the depot maintenance criteria is to provide world-wide Army commands and their logistic support elements with guidance for the establishment of a Depot Maintenance Program and determination of when an aircraft should or must be programmed for Programmed Depot Maintenance (PDM).

b. The following are definitions and data used as planning criteria for selecting aircraft for PDM.

(1) Mandatory Time Between Overhaul (TBO): That time expressed in flying hours of operation or time interval since new or last overhaul when an aircraft must be programmed into PDM.

(2) Mean Time Between Overhaul (MTBO): That time factor or depot maintenance criteria expressed in flying hours/months and used for programming aircraft into depot maintenance for cyclic overhaul which represents the average time attained by the total density of aircraft.

(3) First Line Aircraft: All aircraft in production and those aircraft out of production, that are mission essential and deployable to a combat theater. This includes the following aircraft OH-6A, OH-58A, AH-1G, UH-1-all series (except A), CH-47-all series, CH-54-all series.

(4) Second Line Aircraft: All aircraft not included in the first line category.

(5) Condition: The condition of an aircraft is established by a technical inspection which determines whether an aircraft should be retained in operation or recommended for PDM. Condition determination will be based on the following factors: Safety of Flight, Technical Ability to Accomplish the Work, Man-Hour Capability to Keep the Aircraft

in Serviceable Condition; Modifications Required and Consideration of Theater Requirements for the Aircraft, in Event a Replacement is not Available.

c. Depot Maintenance Criteria.

(1) Combat Operations.

Aircraft	Mean Time Between Overhaul (MTBO)	Mandatory Time Between Overhaul (TBO)
UH-1B/C	1800 Hrs or 24 Months	2700 Hrs or 26 Months
UH-1D/H	2700 Hrs or 36 Months	3300 Hrs or 36 Months
AH-1G	2200 Hrs or 30 Months	3300 Hrs or 36 Months
CH-47/CH-54	2100 Hrs or 30 Months	2400 Hrs or 36 Months
LOH/OH-6A/OH-58A	2100 Hrs or 30 Months	2400 Hrs or 36 Months

(2) Peacetime Operations: There are no mandatory TBO's. Planning Factors are:

(a) First Line Aircraft -- 60 Months.

(b) Second Line Aircraft -- Condition.

2. <u>Portion of the Fleet in Overhaul</u>:

a. Table 1 gives a breakdown of the number of aircraft having gone through depot (organic), for both crash and battle damage and high time. Table 1 is set up on a monthly basis from Sept 1968 to Apr 1972. Illustration 1 shows the number of aircraft backlogged (awaiting induction into overhaul system) at the depot. Illustration 2 gives a month by month accounting of aircraft having been processed through the depot.

b. Table 2 gives a breakdown of the number of aircraft having gone through depot (contract), for crash and battle damage. The Table does not show backlog as the contractor does not keep records on this. Illustration 3 gives a monthly breakdown of the aircraft having been processed through the depot.

TABLE 1

NUMBER OF AIRCRAFT IN OVERHAUL

(ORGANIC)

DATE	*REASON AT DEPOT	BACKLOG	ACFT IN PROCESS	OUTPUT	*REASON AT DEPOT	BACKLOG	ACFT IN PROCESS	OUTPUT	TOTAL FLEET	TOTAL AT DEPOT	% OF FLEET
Sept 68	CD	10	4	0					411	14	3.4[illegible]
Oct 68	CD	9	5	0					445	14	3.15
Nov 68	CD	7	6	1					479	13	2.71
Dec 68	CD	4	8	0					511	12	2.35
Jan 69	CD	11	8	0					540	19	3.52
Feb 69	CD	13	12	2					567	25	4.41
Mar 69	CD	15	17	0					590	32	5.42
Apr 69	CD	19	10	1					611	29	4.75
May 69	CD	31	8	0	HT	0	2	0	633	41	6.48
June 69	CD	41	7	1	HT	0	0	2	636	48	7.55
July 69	CD	37	20	2					551	57	8.76
Aug 69	CD	14	24	0					656	38	5.79
Sept 69	CD	22	21	5					665	43	6.47
Oct 69	CD	15	21	4					678	36	5.31
Nov 69	CD	20	19	3					687	39	5.68
Dec 69	CD	21	19	1					693	40	5.77

TABLE 1

NUMBER OF AIRCRAFT IN OVERHAUL

(ORGANIC)

DATE	*REASON AT DEPOT	BACKLOG	ACFT IN PROCESS	OUTPUT	*REASON AT DEPOT	BACKLOG	ACFT IN PROCESS	OUTPUT	TOTAL FLEET	TOTAL AT DEPOT	% OF FLEET
Jan 70	CD	27	13	8					696	40	5.75
Feb 70	CD	27	17	4					699	44	6.29
Mar 70	CD	26	20	3					702	46	6.55
Apr 70	CD	16	25	1					706	41	5.81
May 70	CD	11	24	4					698	35	5.01
June 70	CD	26	15	9					693	41	5.92
July 70	CD	26	25	2	HT	2	3	0	686	56	8.12
Aug 70	CD	18	34	9	HT	2	5	0	672	59	8.78
Sept 70	CD	18	33	8	HT	2	5	0	658	58	8.81
Oct 70	CD	18	43	0	HT	5	6	0	645	72	11.16
Nov 70	CD	11	41	7	HT	1	6	4	631	59	9.35
Dec 70	CD	11	40	8	HT	1	8	0	625	60	9.60
Jan 71	CD	9	50	5	HT	12	10	0	621	81	13.04
Feb 71	CD	14	38	18	HT	10	19	5	612	81	13.24
Mar 71	CD	17	27	22	HT	6	22	7	598	72	12.04

TABLE

NUMBER OF AIRCRAFT IN OVERHAUL

(ORGANIC)

DATE	*REASON AT DEPOT	BACKLOG	ACFT IN PROCESS	OUTPUT	*REASON AT DEPOT	BACKLOG	ACFT IN PROCESS	OUTPUT	TOTAL FLEET	TOTAL AT DEPOT	% OF FLEET
Apr 71	CD	14	30	11	HT	4	23	8	583	71	12.18
May 71	CD	26	32	9	HT	13	19	7	579	90	15.54
June 71	CD	20	34	15	HT	8	13	10	574	75	13.07
July 71	CD	6	41	8	HT	0	16	5	568	63	11.09
Aug 71	CD	5	36	8	HT	1	11	6	571	53	9.28
Sept 71	CD	3	27	12	HT	3	10	4	574	43	7.49
Oct 71	CD	2	17	11	HT	1	9	3	571	29	5.08
Nov 71	CD	1	9	11	HT	0	13	2	583	23	3.95
Dec 71	CD	1	9	4	HT	1	18	6	597	29	4.86
Jan 72	CD	3	11	1	HT	1	19	4	609	34	5.58
Feb 72	CD	4	15	1	HT	7	17	6	623	43	6.90
Mar 72	CD	4	14	6	HT	14	24	8	638	56	8.78

*NOTE: The abbreviations CD and HT were used. CD meaning Crash and Battle Damage and HT meaning High Time.

ILLUSTRATION 1

AIRCRAFT AT DEPOT

AH-1G
(ORGANIC)

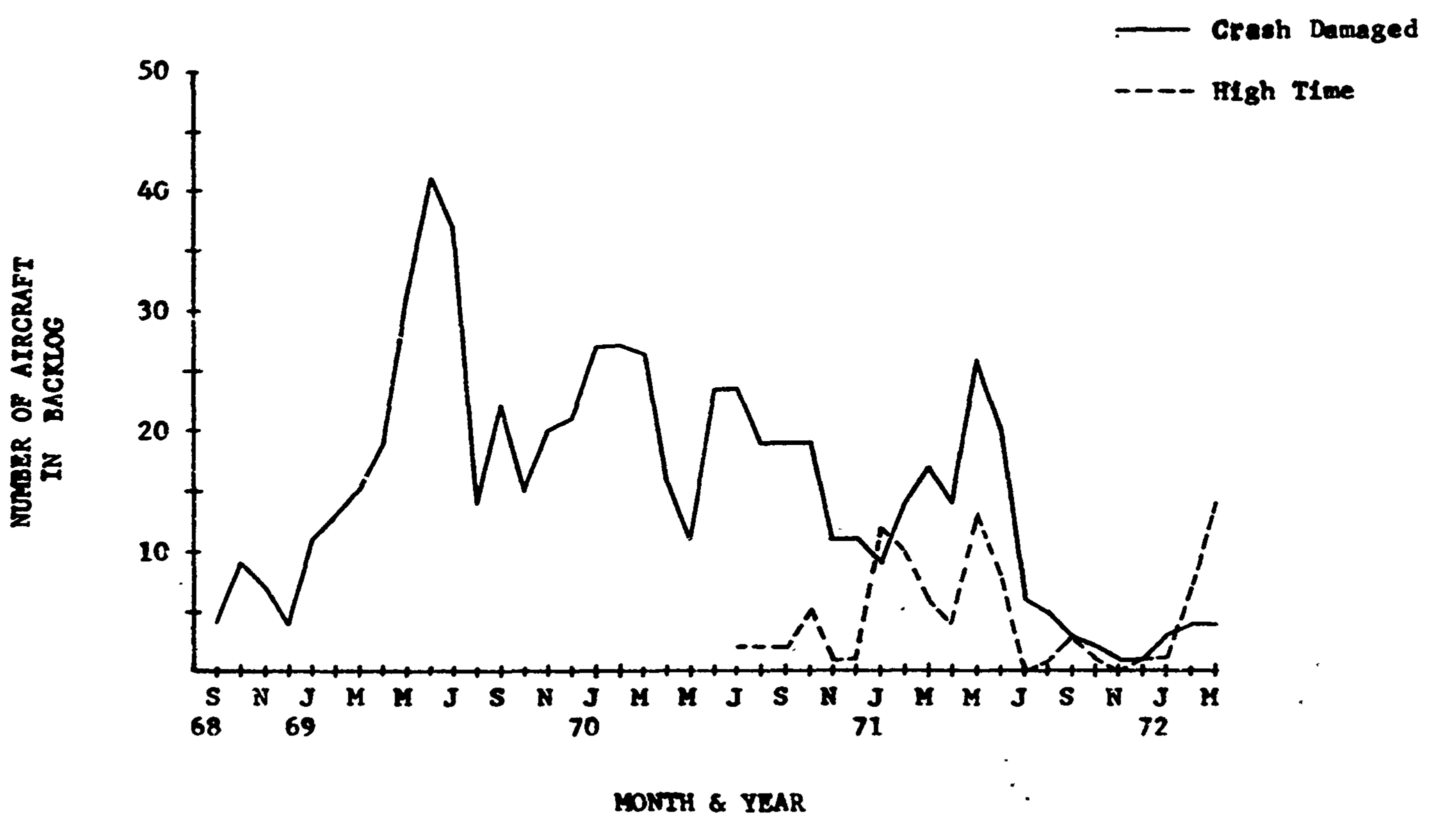


ILLUSTRATION 2

AIRCRAFT AT DEPOT

AH-1G
(ORGANIC)

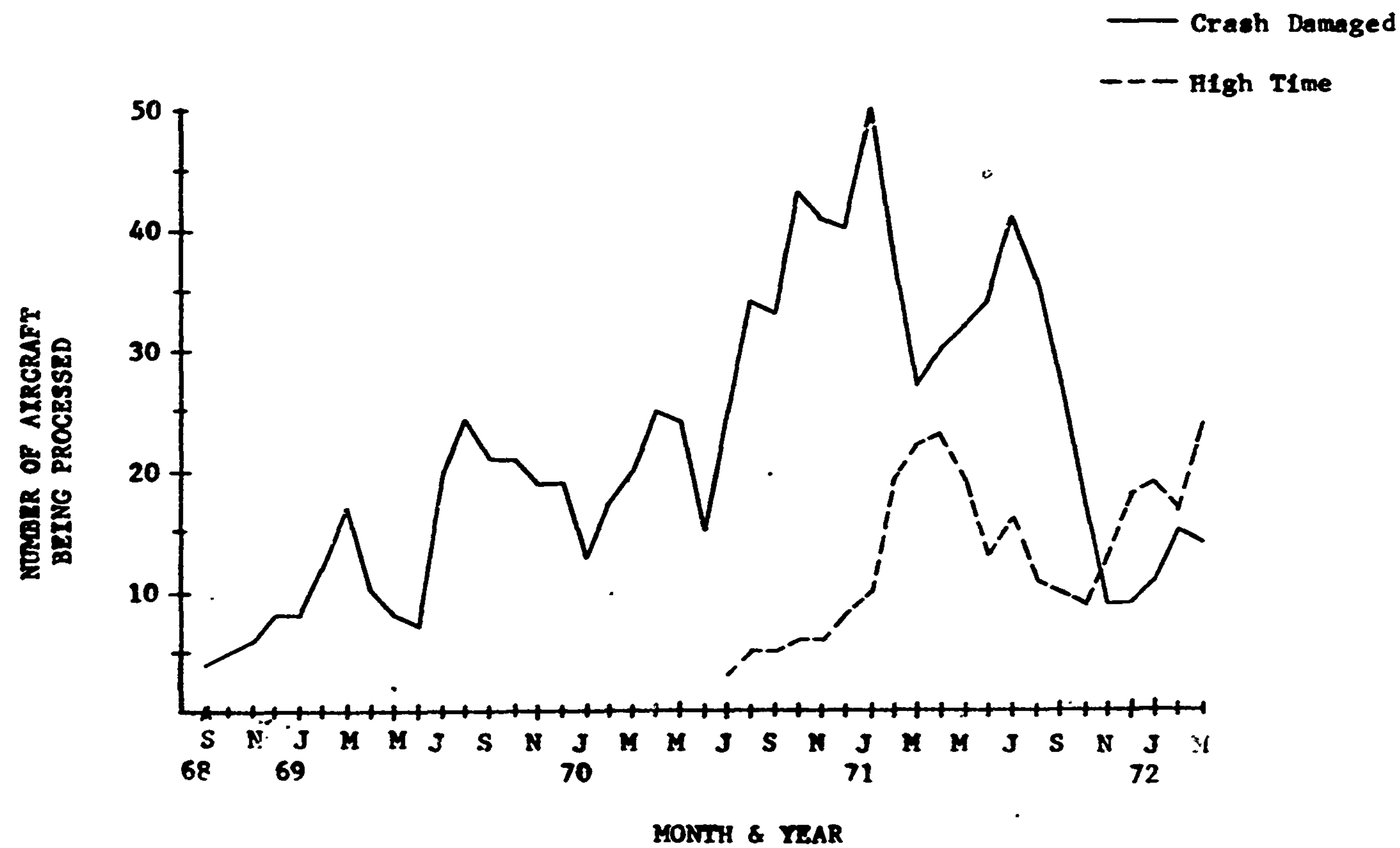


TABLE 2

NUMBER OF AIRCRAFT IN OVERHAUL

(CONTRACT)

DATE	REASON AT DEPOT	ACFT IN PROCESS	OUTPUT	TOTAL FLEET	TOTAL AT DEPOT	% OF FLEET
Apr 69	CD	22	0	611	22	3.60
May 69	CD	20	4	633	24	3.79
June 69	CD	20	2	636	22	3.46
July 69	CD	18	4	651	22	3.38
Aug 69	CD	35	5	656	40	6.10
Sept 69	CD	29	5	665	34	5.11
Oct 69	CD	30	4	678	34	5.16
Nov 69	CD	36	4	687	40	5.82
Dec 69	CD	41	7	693	48	6.93
Jan 70	CD	35	6	696	41	5.89
Feb 70	CD	31	4	699	35	5.00
Mar 70	CD	25	6	702	31	4.42
Apr 70	CD	29	8	706	37	5.24
May 70	CD	36	6	698	42	6.02
June 70	CD	44	6	693	50	7.22
July 70	CD	38	8	686	46	6.71

TABLE 2

NUMBER OF AIRCRAFT IN OVERHAUL

(CONTRACT)

DATE	REASON AT DEPOT	ACFT IN PROCESS	OUTPUT	TOTAL FLEET	TOTAL AT DEPOT	% OF FLEET
Aug 70	CD	30	8	672	38	5.65
Sept 70	CD	21	9	658	30	4.56
Oct 70	CD	14	7	645	21	3.26
Nov 70	CD	7	7	631	14	2.22
Dec 70	CD	5	2	625	7	1.12
Jan 71	CD	3	2	621	5	.81
Feb 71	CD	2	1	612	3	.49
Mar 71	CD	2	0	598	2	.33
Apr 71	CD	2	0	583	2	.34
May 71	CD	2	0	579	2	.35
June 71	CD	1	1	574	2	.35
July 71	CD	1	0	568	1	.18
Aug 71	CD	1	0	571	1	.18
Sept 71	CD	1	0	574	1	.17
Oct 71	CD	1	0	571	1	.18
Nov 71	CD	1	0	583	1	.17

TABLE 2

NUMBER OF AIRCRAFT IN OVERHAUL

(CONTRACT)

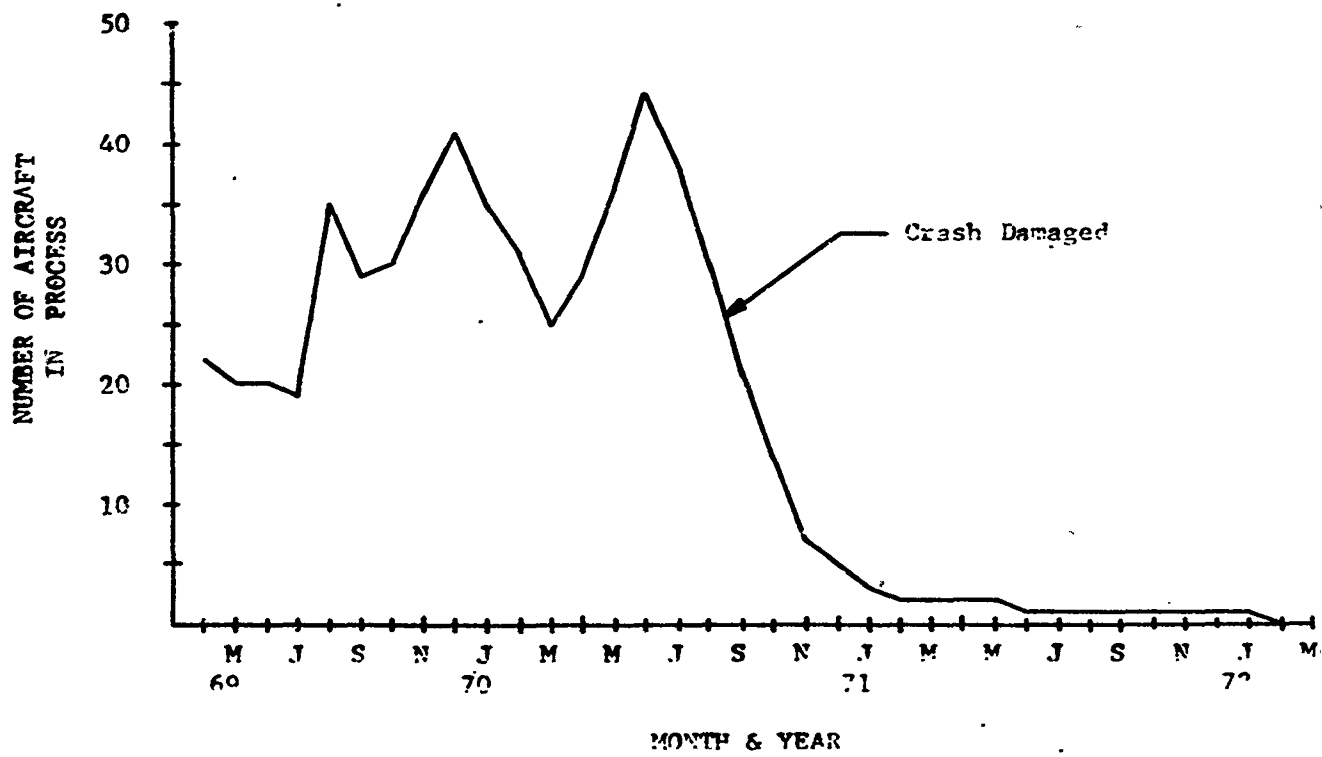
DATE	REASON AT DEPOT	ACFT IN PROCESS	OUTPUT	TOTAL FLEET	TOTAL AT DEPOT	% OF FLEET
Dec 71	CD	1	0	597	1	.17
Jan 72	CD	1	0	609	1	.16
Feb 72	CD	0	1	623	1	.16
Mar 72		0	0	638	0	0

ILLUSTRATION 3

AIRCRAFT AT DEPOT

AH-1G

(CONTRACTOR)



3. Return Schedule:

For a schedule of aircraft returns in FY 1972 see Table 3. Table 3 gives the schedule of returns for both high time aircraft, and crash and battle damage aircraft. It also breaks out, separately those aircraft scheduled for project extend.

TABLE 3

DEPOT RETURNS SCHEDULE (FY 72)

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Estimated Returns	0	11	0	3	9	10	7	16	11	11	8	6
Actual Returns	0	2	4	0	6	12	5	10	22	22		

PROJECT EXTEND AIRCRAFT (FY 72)

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Estimated Returns											24	24
Actual Returns								2	1	10		

4. Overhaul Cost:

Aircraft are returned to depot for overhaul for one of three reasons. These are listed below along with their appropriate cost.

a. Project Extend Aircraft -- $25,000.00.

b. High Time Aircraft -- $75,000.00.

c. Crash Damage Aircraft -- $100,000.00.

AH-1G CYCLIC OVERHAUL PROGRAM

AH-1G CYCLIC OVERHAUL PROGRAM

This chapter will include results of an analysis of data on AH-1G aircraft which have been processed through depot-level cyclic overhaul. These results will be used as a basis for recommending suitable overhaul criteria designed to:

a. Decrease cyclic overhaul costs.

b. Increase aircraft availability.

The analyses in this chapter will consist of the following sections:

a. Aircraft Out of Service Time Analysis - An examination of the various factors contributing to non-availability of the aircraft due to the need for cyclic overhaul. Out of service time refers to the total turnaround time involved in the overhaul operation, and consists of the following phases:

(1) Transit - The interval beginning after the owning unit releases the aircraft for shipment to depot and ending after arrival of the aircraft at the depot.

(2) Storage - The interval during which the aircraft is stored in the depot as part of its backlog inventory.

(3) Process - The interval during which the aircraft is actually on the assembly line being inspected and overhauled.

(4) Delivery - The interval beginning after completion of the overhaul and ending after receipt of the aircraft by its next owner unit.

b. Aircraft Maintenance Action Analysis - An examination of the effect of the number of required maintenance actions on out of service time and, in particular, process time.

c. Aircraft Flight Hour Analysis - An attempt to determine if the number of flight hours logged by the aircraft has an effect on out of service time or number of maintenance actions. This section will also include a list of the parts repaired or replaced which show an increasing maintenance trend (i.e. an increasing number of maintenance actions) as the number of aircraft flight hours increases.

d. Aircraft Calendar Age Analysis - An attempt to determine if the calendar age of the aircraft has an effect on out of service time or number of maintenance actions. This section will also include a list of the parts repaired or replaced which show an increasing maintenance trend as the calendar age of the aircraft increases.

e. Parts Failure Mode Analysis - The parts showing increasing maintenance trends by flight hour and/or calendar age are analyzed to determine the three dominant (i.e. most frequent) failure modes for each.

f. MWO Compliance Data - Engineering Change Proposals (ECP's) which are approved and become Modification Work Orders (MWO's) are frequently implemented at the depot during cyclic overhaul. It is a fact, however, that many of these MWO's could have been complied with in the field at a lower echelon of maintenance, thereby reducing total process time at the depot. In an effort to better monitor the MWO compliance program, the following information will be obtained from the depot:

(1) Purpose and description of the MWO.

(2) Number of manhours required for compliance.

(3) Cost of the MWO and who was paid for it.

(4) The lowest maintenance level at which the MWO kit could have been installed.

All of the above analyses are, of course, predicated on the availability of required data. The primary sources for this data are 2407 forms and local depot records, the latter hopefully providing the above MWO compliance data. Thus far, however, no cyclic overhaul data has been reported on the AH-1G aircraft nor has it been reported on any aircraft since September 1970. Action has been taken to implement the provisions of DA Cir 750-35, which explicitly prescribes such reporting. The latest indications are that overhaul data reporting has once again been resumed; however, it will be some time before sufficient data can be collected and processed to enable a meaningful analysis to be performed.

SYSTEM AND SUBSYSTEM RELIABILITY AND MAINTAINABILITY CHARACTERISTICS

The primary objective of this chapter is to present parameters indicative of the reliability and maintainability of the end item at different functional levels. The two subjects will normally be presented as separate chapters in future Management Summary Reports; for reasons of expediency and temporary data base limitations that will be further elaborated upon, the two are combined in this report.

The data base from which the parameters in this chapter were generated consists of six months of AH-1G field data, reported via the TAMMS (TM 38-750) information system. Maintenance reporting from the organizational, direct support and general support echelons on end item aircraft, as well as maintenance reporting on major items comprise the data base, referred to as the Maintenance Action File. This file is the result of intensive efforts to establish an edited maintenance file which can be interrogated for all Reliability, Availability, Maintainability, utilization, and logistical related parameters by automated techniques.

The file is essentially in life cycle sequence by aircraft serial number for those aircraft for which data exists. Edits have been performed on nearly all fields within a record, including the end item, component, flight hour, and data fields. In order to effectively utilize all data, the component edit consisted of a series of edits culminating in the generation of a Work Unit Code System for the AH-1G fleet. The system, characterized as a system-subsystem breakdown, is presently being utilized as an in-house tool to enable structuring of the maintenance at all levels. It permits the delineation of all reported maintenance to its respective level within a given functional group and facilitates the generation of subject RAM related parameters.

Utilizing the Work Unit Code System, all maintenance reported against the AH-1G fleet for the subject time frame was assigned to respective functional groups, and as possible, the section, installation, assembly, subassembly, and part level. If it was not possible to assign a maintenance action to an applicable functional area, it was assigned to the end item aircraft level (e.g., daily and intermediate inspections).

All parameters are based on six months of data. In order to allow for inherent voids in reporting, which could be due to non-reporting, erroneous or lost records, or errors incorporated by data reduction at the keypunch facility, it was necessary to adjust the accumulated flight hour totals to be commensurate with the total maintenance actions reported. With this objective in mind, a gap analysis was performed on the data. It was concluded that for a sample of 619 aircraft that had reporting in the subject time frame (1 July 70 to 31 Dec 70), a total of 72,990 maintenance actions were reported against a flight hour profile of 95,476 flight hours. In that period there was an additional 55,271 accumulated flight hours, or gap hours, that had no reporting; this was equivalent to 39% of the total acceptable flight hours. The total acceptable flight hour value provided the base for evaluating all other RAM related parameters.

As previously stated, major component statistics (DA Form 2410 reporting) are included in the Maintenance Action File. Upon their inclusion into the file, it is necessary to make a determination as to the number and type of inserted documents that represent a corresponding number of replacement actions. Because the automated routine that performs this function is not yet operational, it is necessary at this time to generate the replacement statistics for the major components utilizing data from the Major Items Chapter of this report. Using the flight hour base of 95,476 hours and the average time since last installation of the major items, a projected number of replacements could be ascertained.

The RAM related parameters presented in this chapter have been selected with the intent of providing parameters unaffected by the temporary data base limitations. Those generated for the end item and functional group levels are displayed in Table 1. At these levels, the following parameters are presented:

A. Total Number of Maintenance Actions.

B. Total Number of Replace Actions.

C. Total Number of Repair Actions.

D. Mean Time Between Maintenance Actions.

E. Mean Time Between Replace Actions.

F. Mean Time Between Repair Actions.

Below the end item and functional group levels, illustrations aid in the identification of those sections, installations, assemblies, subassemblies, or parts that have received inordinately high maintenance. For each illustration, the subject items are identified by a reference number. Following each set of illustrations for a given functional group, there is a corresponding table that displays associated RAM parameters, keying on the reference numbers of the items on each illustration. The reference number, its noun nomenclature, and the following parameters are presented on each table:

A. Total Number of Maintenance Actions.

B. Total Number of Replace Actions.

C. Total Number of Repair Actions.

D. Average Maintenance Manhours Per Maintenance Action.

E. Average Maintenance Manhours Per Replace Action.

F. Average Maintenance Manhours Per Repair Action.

G. Dominant Reported Failure Mode.

The maintenance manhour information could not be presented at the end item or functional group levels because of the necessity to edit the field on all maintenance reporting, which is often left blank or obviously in error. The automated technique performing this function is being implemented at this time. Maintenance manhours above the subject item level is meaningless until the edit is completed.

This chapter will be subject to change in future reports as the aforementioned edits are implemented. For a given time, the reliability at the end item and all subordinate levels will be determined. More comprehensive maintainability parameters, including maintenance manhours per flight hour, will be generated. The data base for each fleet will be enlarged and the time frame more recent as field reporting and submission of data to AVSCOM improve.

TABLE 1

FUNCTIONAL LEVEL BREAKDOWN

AH-13 (End Item Aircraft)

A - 72,990
B - 24,368
C - 2124
D - 1.[illegible]1
E - 3.92
F - 44.95

	FG01 Airframe	FG02 Landing Gear	FG03 Power-plant System	FG04 Transmission and Drive Sys.	FG06 Hydraulic System	FG08 Instruments and Panels
A	3706	515	3,477	12,160	2323	989
B	1937	473	2,271	9,182	1926	579
C	1008	14	91	125	26	18
D	257.6	1853.9	27.5	7.8	41.1	96.5
E	492.9	2018.5	42.0	10.4	49.6	164.9
F	947.2	6819.7	1044.9	763.8	3672.2	5309.7

	FG09 Electrical System	FG10 Fuel System	FG11 Flight Control System	FG12 Utility System	FG19 Avionics System	FG30 Armament System
A	1549	1556	1478	285	3131	428
B	697	1465	574	142	535	48
C	127	10	14	31	37	51
D	63.4	61.4	64.6	3350.0	30.0	2230.7
E	137.0	65.2	166.3	672.3	178.5	1989.1
F	751.8	954.7	6819.7	3079.7	2580.4	1872.1

A - Total Maintenance Actions
B - Total Replace Actions
C - Total Repair Actions
D - Mean Time Between Maintenance Actions
E - Mean Time Between Replace Actions
F - Mean Time Between Repair Actions

ILLUSTRATION 1

FG01
FORWARD SECTION

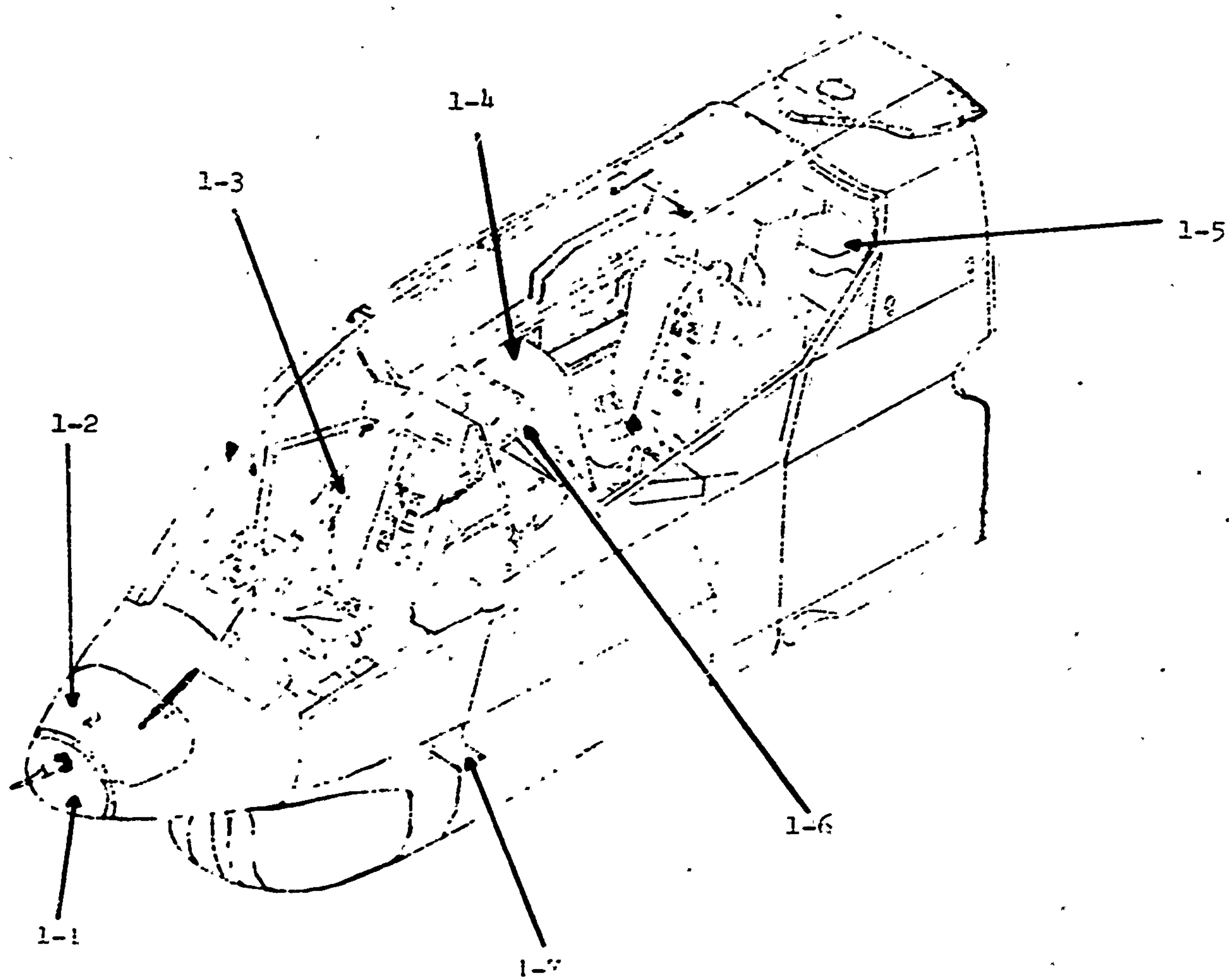


ILLUSTRATION 2

FG 01
FORWARD SECTION

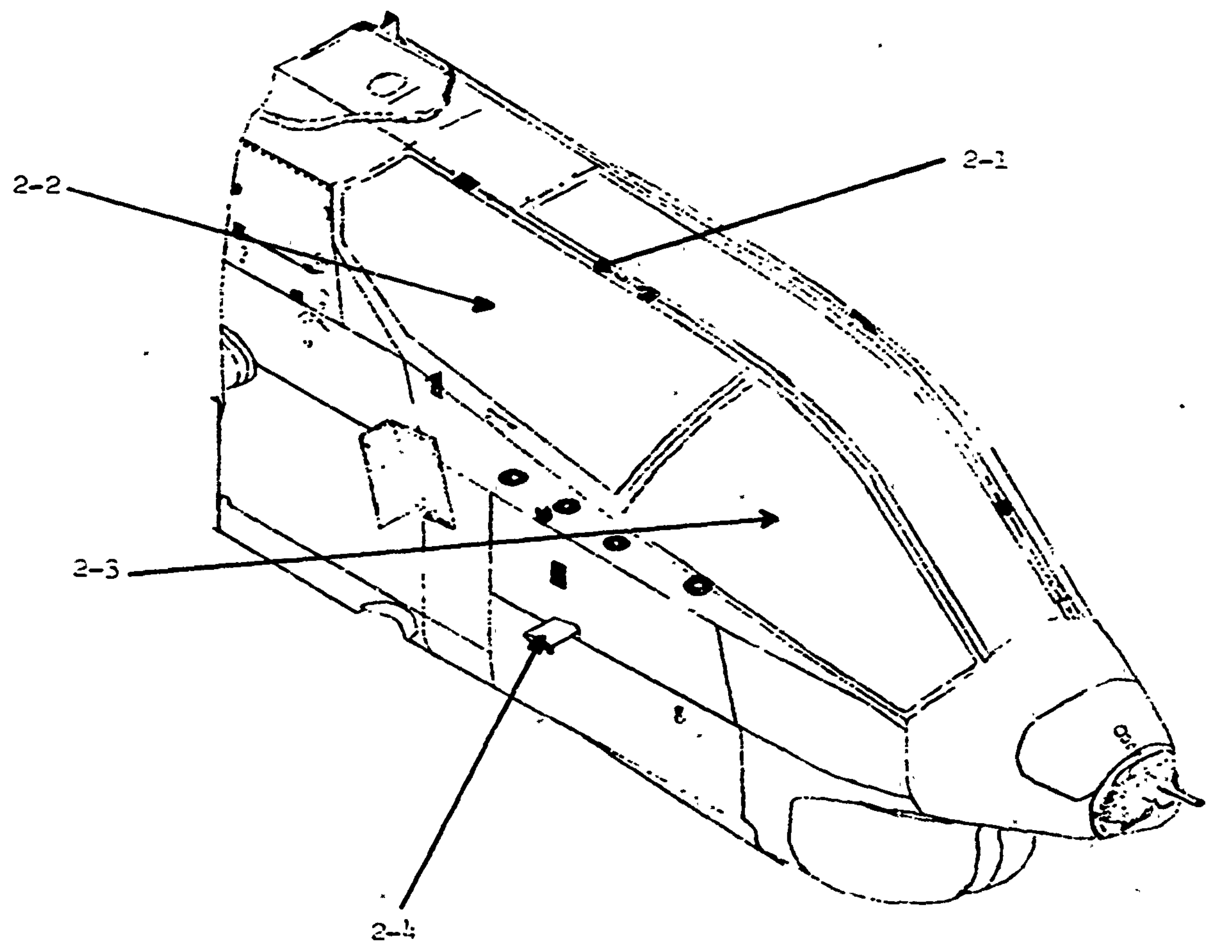
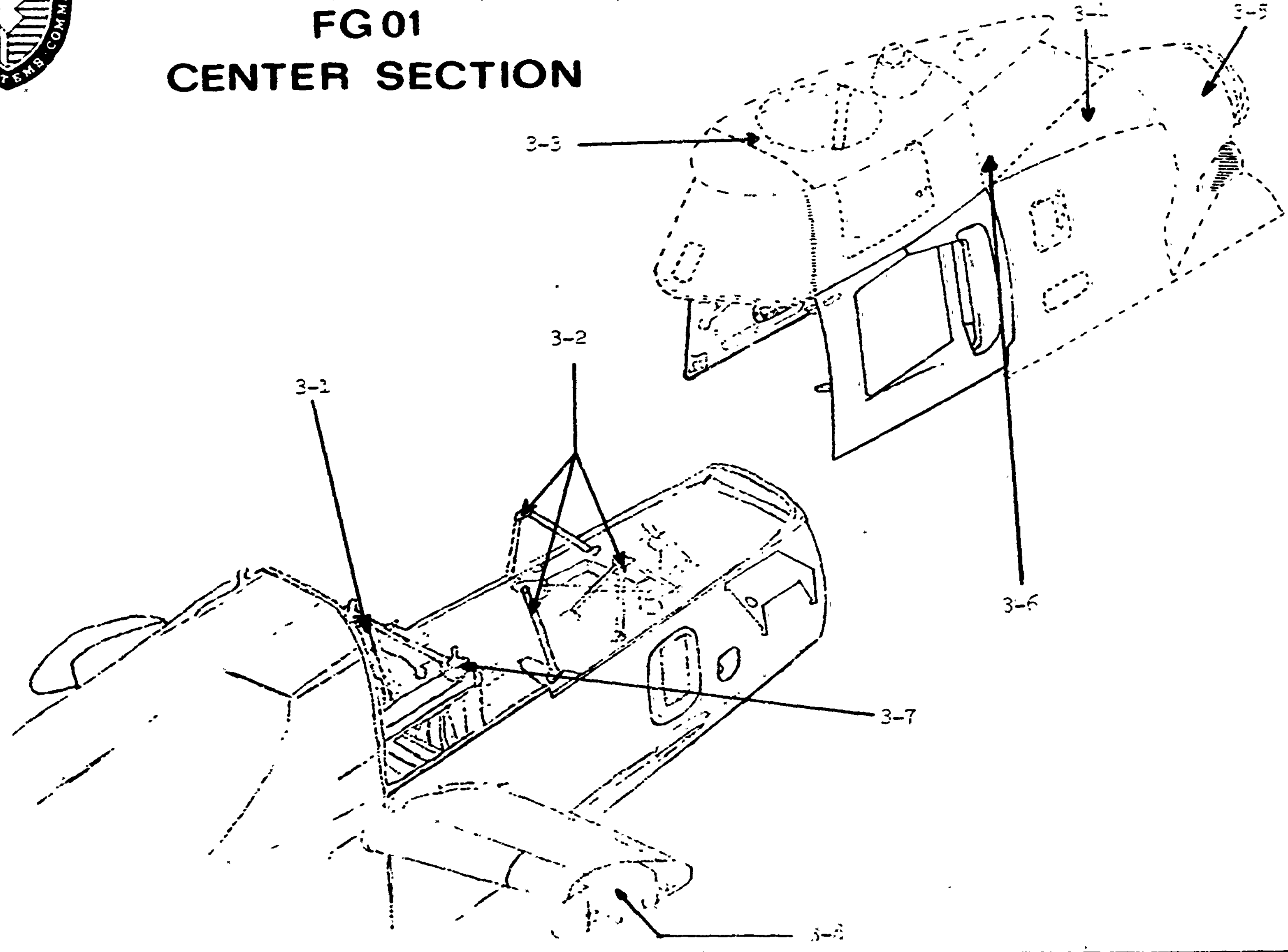


ILLUSTRATION 3

FG 01
CENTER SECTION



FG01
AFT SECTION

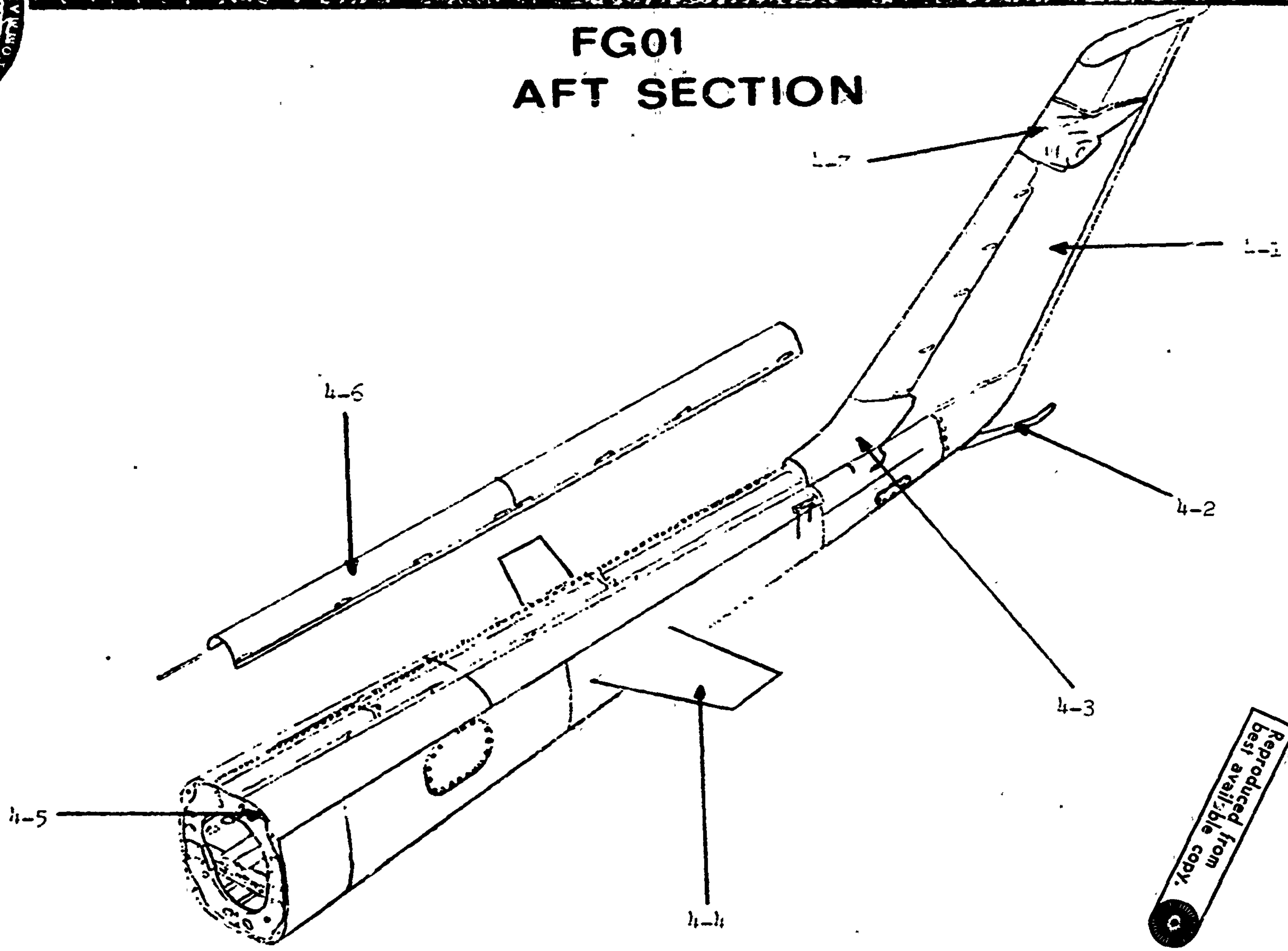


TABLE 2

FUNCTIONAL GROUP 01 AIRFRAME

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
1-1	Nose Assy	41	8	32	6.1	18.5	3.1	Loose
1-2	Nose Door Assy	25	15	6	1.8	26.0	12.0	Broken
1-3	Gunners Door Assy	45	18	12	10.5	20.3	4.1	Broken
1-4	Glareshield Assy	50	39	11	4.1	4.8	1.3	Broken
1-5	First Aid Kit	11	9	1	0.6	0.6	1.0	Missing
1-6	Canopy Strut Assy	40	31	1	3.1	112.2	0.5	Excess Wear
1-7	Gunners Step Assy	10	9	1	2.83	22.3	6.0	Broken
2-1	Pilots Door Assy	84	35	19	8.6	16.4	3.2	Broken
2-2	Pilots Window Assy	6	1	3	2.3	8.0	1.0	Battle Dam
2-3	Gunners Window Assy	6	3	1	8.2	14.3	3.0	Chipped
2-4	Pilots Step Assy	14	13	-	7.5	8.0	-	Excess Wear
3-1	XMSN Mount	8	-	1	1.6	-	2.0	Loose
3-2	Engine Mount Assy	145	137	1	4.0	4.0	1.0	Excess Wear
3-3	XMSN Cowl Assy	39	10	18	6.3	13.5	3.7	Broken
3-4	Engine Cowl Assy	48	9	29	4.4	7.6	3.3	Broken

TABLE 2 CONT'D

FUNCTIONAL GROUP 01 AIRFRAME

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
3-5	Exhaust Cowling	34	9	19	4.0	6.2	2.6	Broken
3-6	Aft Pylon Fairing	19	6	4	10.7	15.6	2.5	Broken
3-7	Damper Assy	87	51	3	4.5	6.5	2.0	Excess Wear
3-8	Wing Assy	71	6	13	11.2	14.6	15.3	No Defect
4-1	Vertical Fin Assy	66	6	48	2.4	2.4	2.5	Broken
4-2	Stinger Assy	20	11	6	3.5	2.8	6.1	Broken
4-3	42° G/B Cover	76	48	23	1.3	1.3	1.4	Broken
4-4	Elevator Assy	101	25	26	4.8	5.7	1.8	No Defect
4-5	Tail Boom Assy	130	35	56	42.8	94.6	7.8	Broken
4-6	T/R Driveshaft Cover	83	43	31	3.2	4.3	2.5	Broken
4-7	90° G/B Cover	30	8	19	1.3	1.0	1.4	Broken

ILLUSTRATION F

FG02 LANDING GEAR

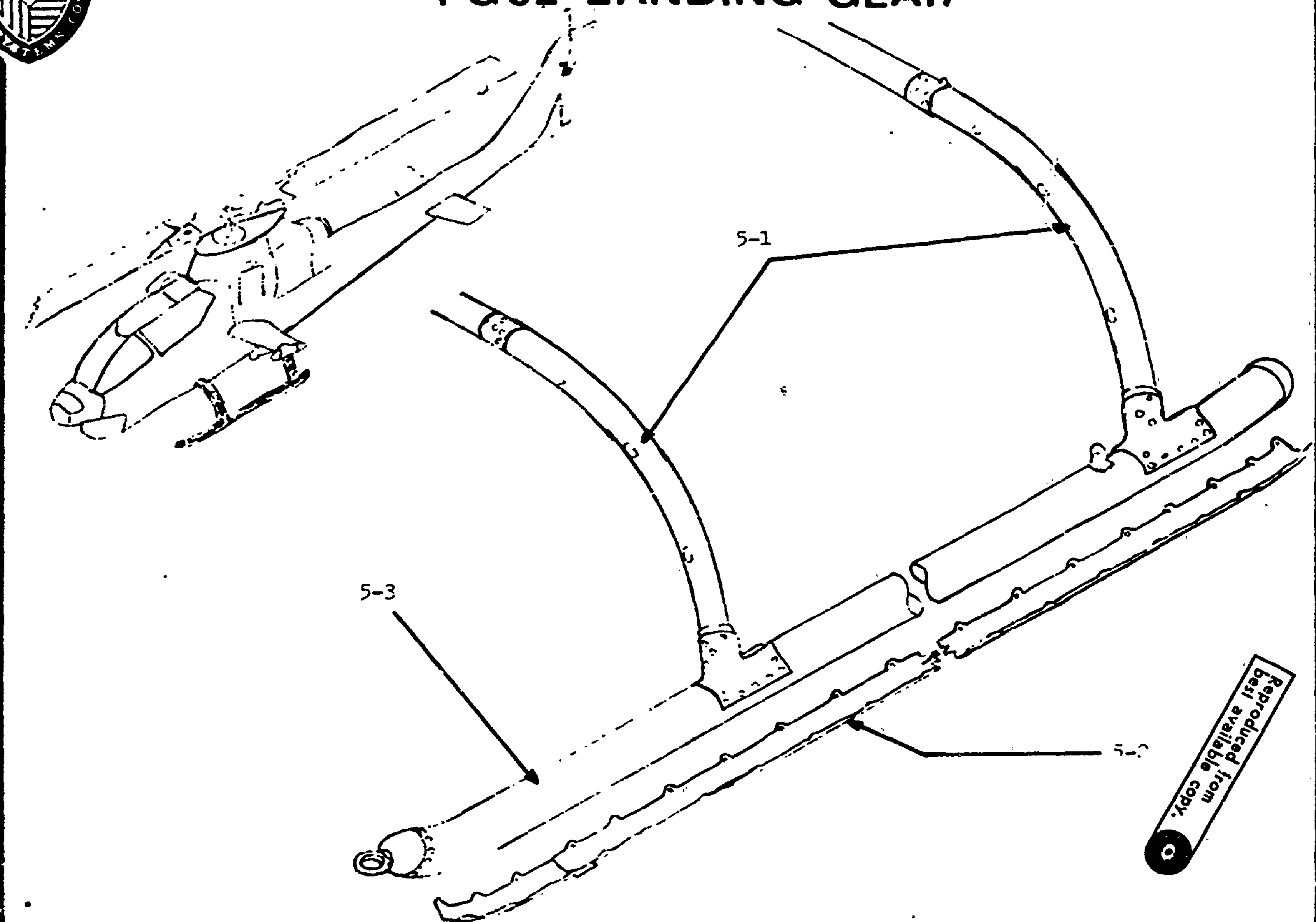


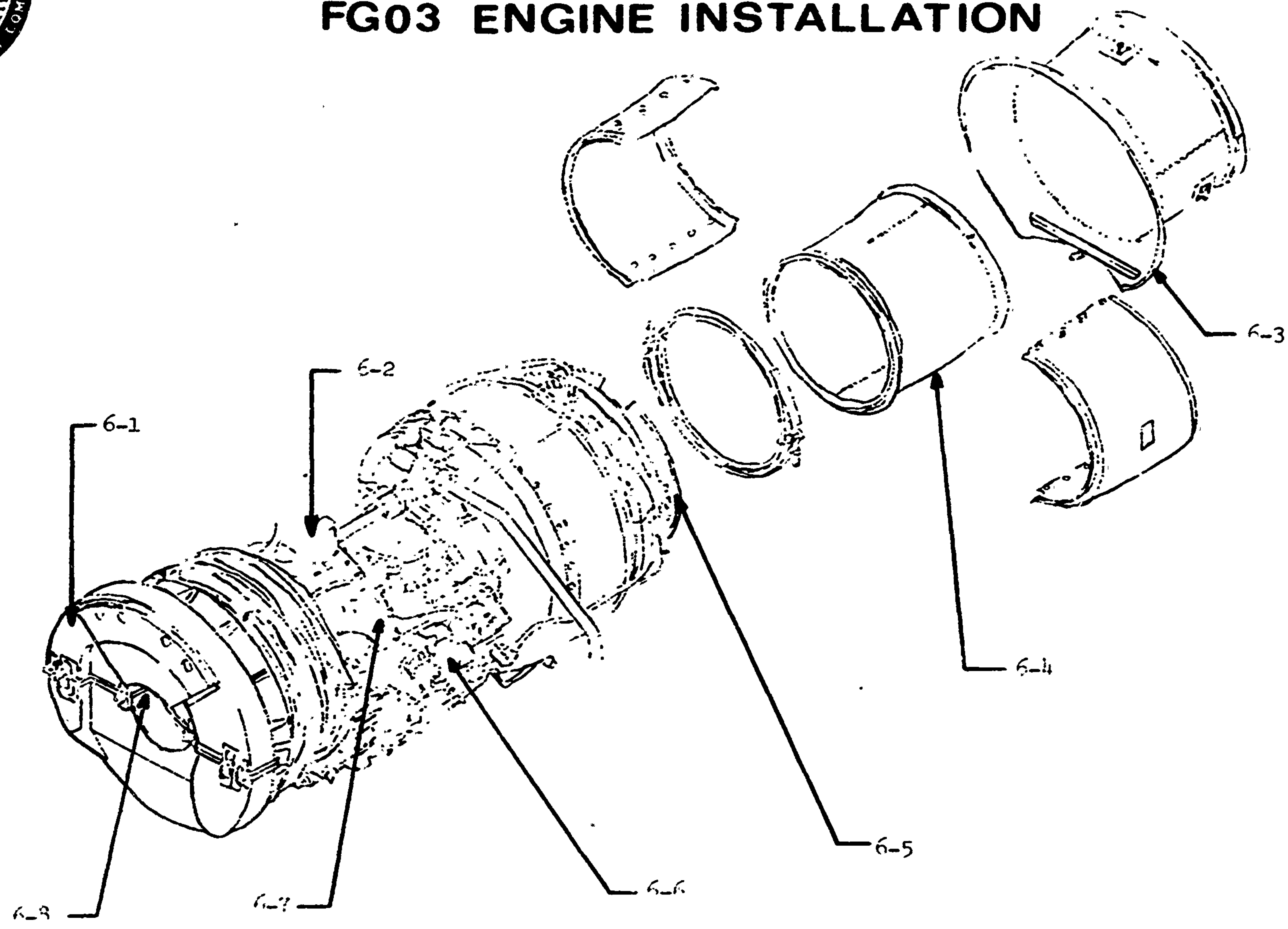
TABLE 3

FUNCTIONAL GROUP 02 LANDING GEAR

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

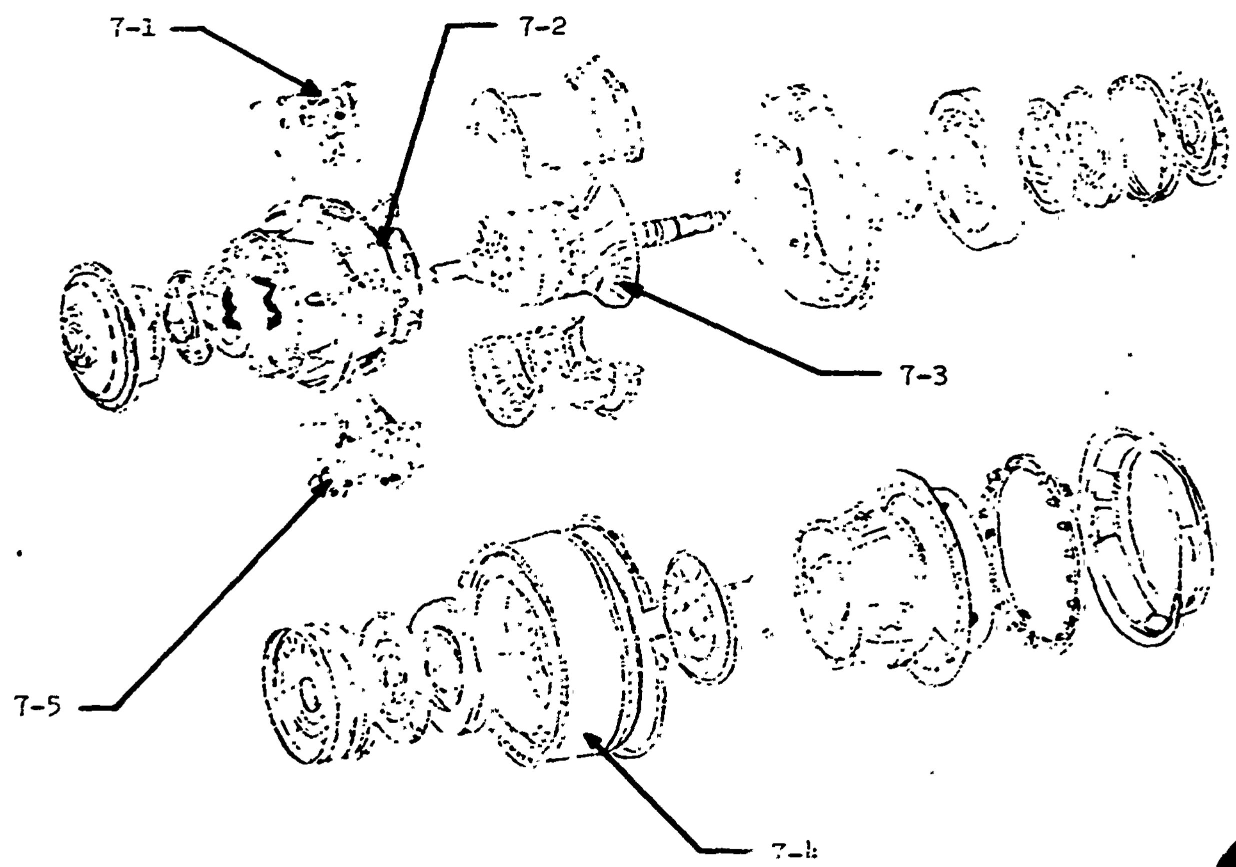
REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
5-1	Crosstube Assy	117	101	9	4.8	4.9	3.4	Collapsed
5-2	Shoe Assy	88	85	-	2.5	2.6	-	Excess Wear
5-3	Skid Assy	241	224	5	5	4.8	5.4	Excess Wear

FG03 ENGINE INSTALLATION



ILLUSTRATION

FG 03 ENGINE ASSY



ILLUSTRATION

FG 03
ENGINE CONTROL INSTALLATION

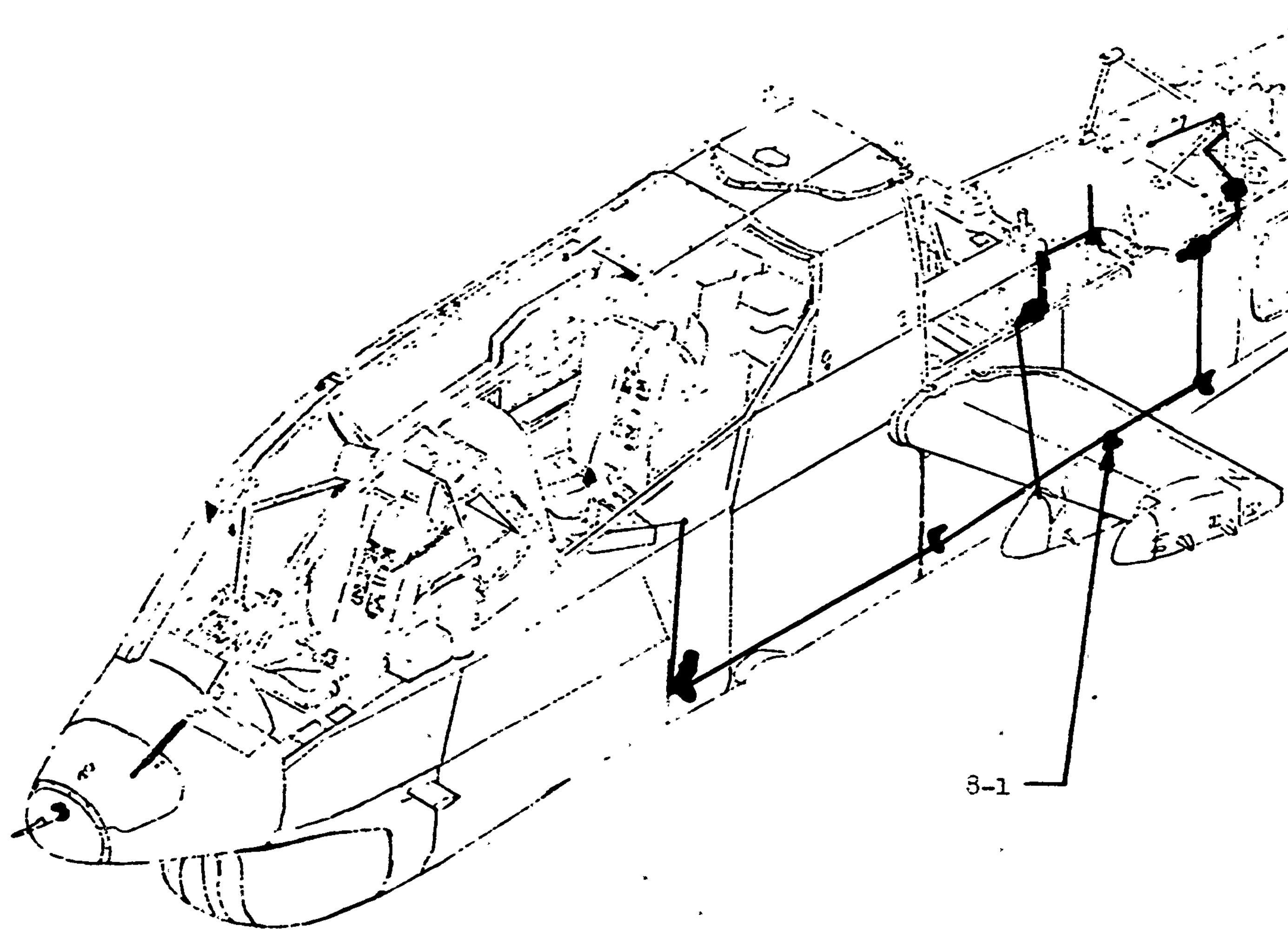


ILLUSTRATION 9

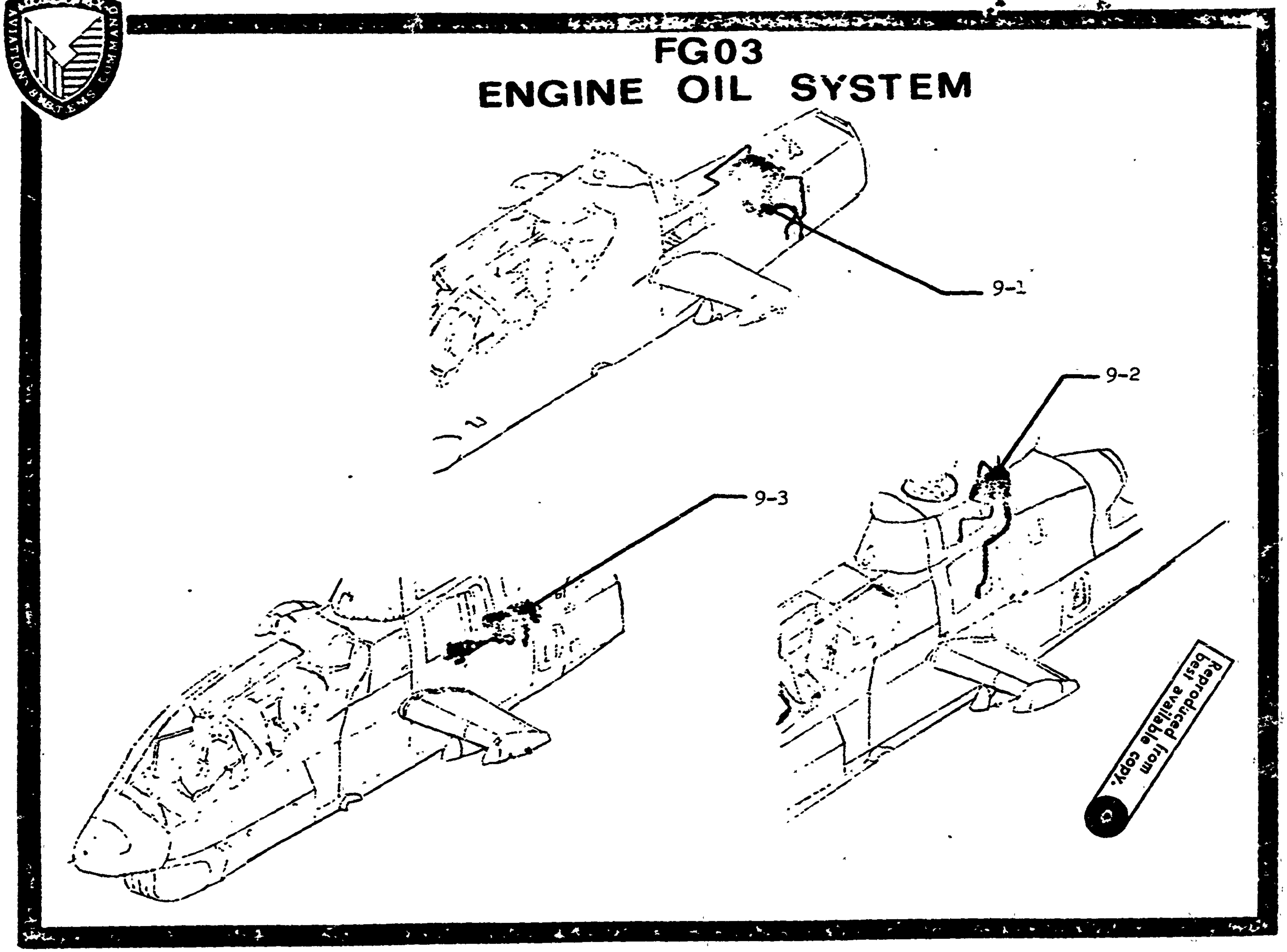


TABLE 4

FUNCTIONAL GROUP 03 POWERPLANT SYSTEM

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
6-1	Particle Separator	43	6	10	3.1	3.9	3.4	No Defect
6-2	Engine Assy	1041	680	27	20.0	25.7	3.7	No Defect
6-3	Ejector Assy	55	44	6	3.0	3.2	3.2	Broken
6-4	Exhaust Cone	44	39	1	3.3	3.6	2.0	Broken
6-5	Heat Shield	61	2	-	8.5	8.5	-	MWO Compl
6-6	Linear Actuator	78	64	1	4.0	4.6	0.5	Clogged
6-7	Fuel Control Assy	213	207	-	3.3	3.3	-	Not Determ
6-8	Collector Box Assy	29	21	4	2.1	2.8	0.2	Broken
7-1	Governor	39	29	1	3.2	3.5	0.4	Improp Adj
7-2	Starter Generator	486	440	2	4.5	4.8	1.7	No Defect
7-3	Compressor	5	1	-	11.2	3.0	-	No Defect
7-4	Turbine Nozzle Assy	123	122	-	4.0	4.0	-	Broken
7-5	Accessory Gearbox	5	2	-	9.9	5.3	-	Chipped
8-1	Idler Assy	16	2	-	0.9	1.5	-	Improp Adj
9-1	Blower Assy	8	3	1	2.9	5.5	2.0	Broken

TABLE 4 CONT'D

FUNCTIONAL GROUP 03 POWERPLANT SYSTEM

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF. NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
9-2	Oil Tank	12	8	-	4.2	4.3	-	Leaking
9-3	Oil Cooler	38	8	5	14.0	15.4	1.9	MWO Compl

ILLUSTRATION 10

FG 04
TRANSMISSION DRIVESHAFTS & GEARBOXES

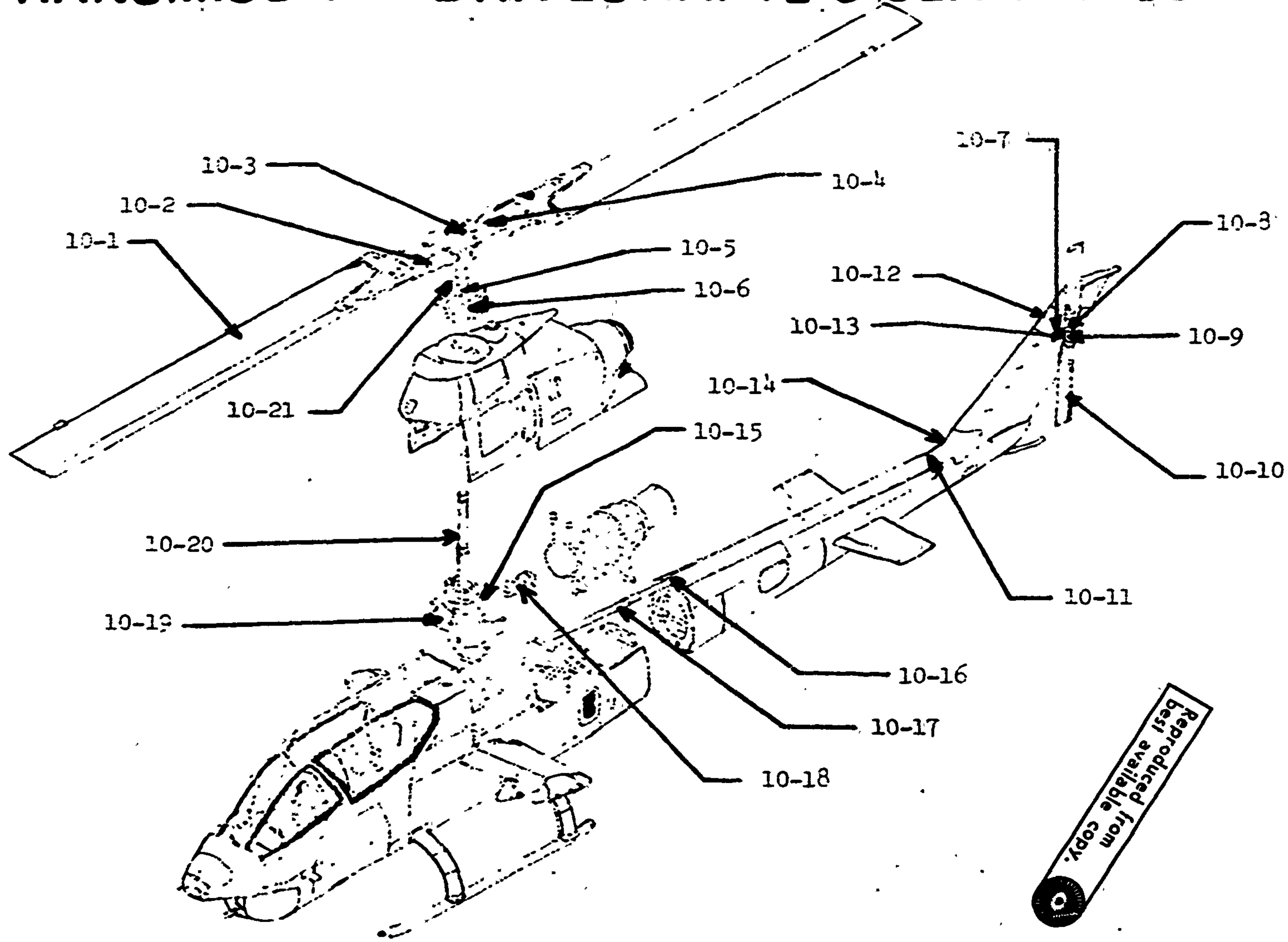


TABLE 5

FUNCTIONAL GROUP 04 TRANSMISSION, GEARBOXES, & DRIVESHAFTS

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
10-1	M/R Blade Assy	1218	1124	16	4.0	3.8	5.9	No Defect
10-2	M/R Hub Extension	338	334	-	5.8	5.8	-	Excess Wear
10-3	M/R Hub Assy	773	575	9	5.5	7.1	7.9	No Defect
10-4	M/R Yoke Assy	2	2	-	4.0	4.0	-	Excess Wear
10-5	Scissors & Sleeve Assy	251	186	1	5.0	4.5	0.4	Excess Wear
10-6	Swashplate & Support Assy	335	255	1	7.0	8.0	24.0	Excess Wear
10-7	Silent Chain Assy	135	121	2	2.5	2.6	2.0	Excess Wear
10-8	Crosshead Assy	114	101	1	2.6	2.1	0.5	Excess Wear
10-9	T/R Hub Assy	539	377	24	3.5	3.6	1.5	Excess Wear
10-10	T/R Blade Assy	798	778	1	2.4	2.3	4.0	No Defect
10-11	Hangar Assy	1152	1100	-	2.1	2.0	-	Excess Wear
10-12	90 Degree Gearbox	328	240	6	4.8	5.2	2.4	Leaking
10-13	T/R Pitch Control Link	155	148	1	3.3	3.0	50.0	Excess Wear
10-14	42 Degree Gearbox	279	182	6	3.1	3.4	3.7	No Defect
10-15	Main Quill Assy	228	220	-	2.3	2.3	-	Leaking

TABLE 5 CONT'D

FUNCTIONAL GROUP 04 TRANSMISSION, GEARBOXES, & DRIVESHAFTS

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
10-16	Hangar Bearing	7	1	-	1.8	1.5	-	Leaking
10-17	T/R Driveshaft Assy	94	72	-	4.6	4.6	-	Chipped
10-18	Eng To XMSN Driveshaft	546	453	1	2.6	2.4	0.5	No Defect
10-19	Transmission Assy	224	179	5	21.5	24.4	2.9	No Defect
10-20	M/R Mast Assy	281	266	2	8.2	8.3	1.5	No Defect
10-21	M/R Pitch Control Link	6	2	-	1.7	0.8	-	Excess Wear

ILLUSTRATION 11

FG 06
HYDRAULIC SYSTEM

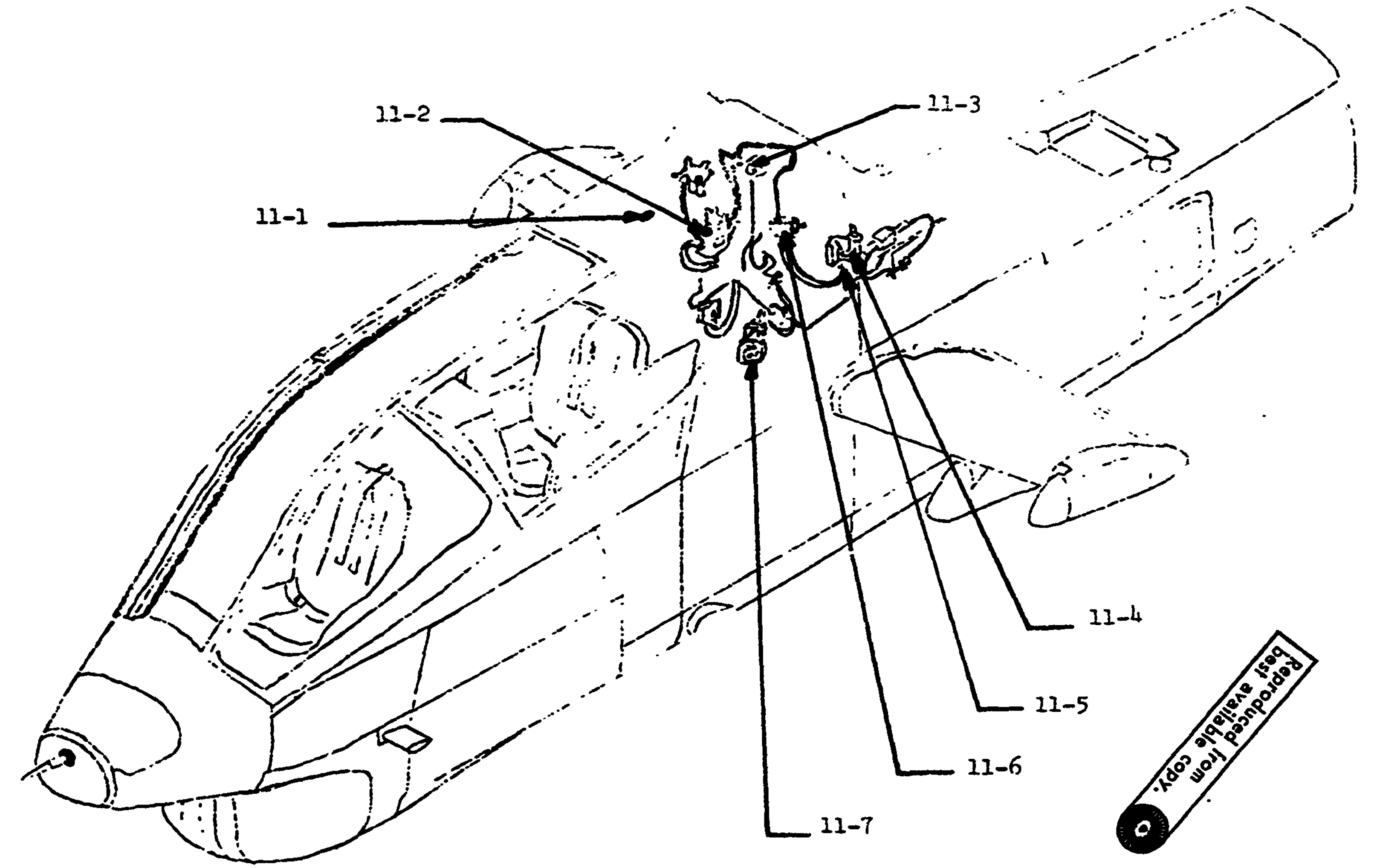


TABLE 6

FUNCTIONAL GROUP 06 HYDRAULIC SYSTEM

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
11-1	Sight Indicator	7	6	1	1.6	1.8	0.5	Leaking
11-2	Reservoir Assy	10	3	2	3.4	8.5	0.6	Leaking
11-3	Hydraulic Pump Assy	11	8	-	4.0	4.2	-	Excess Wear
11-4	Servo Cylinder Assy	1427	1413	3	3.4	3.4	4.3	Leaking
11-5	Solenoid Valve	26	25	-	3.1	3.2	-	Not Determ
11-6	Hydraulic Lockout Valve	48	7	-	6.9	7.5	-	MWO Compl
11-7	Accumulator	30	19	2	2.8	3.4	1.9	Leaking

FG08
PILOT'S INSTRUMENT PANEL

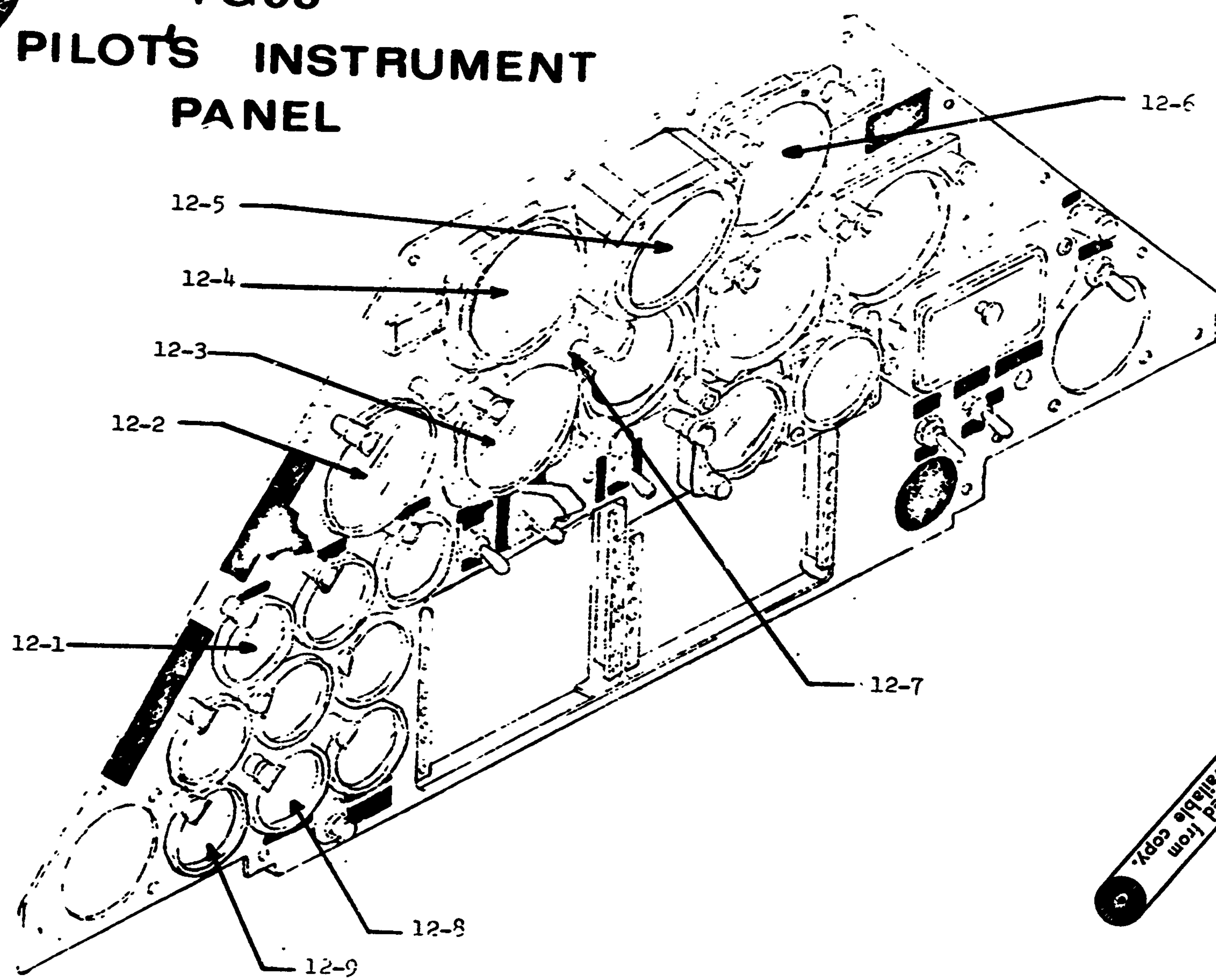
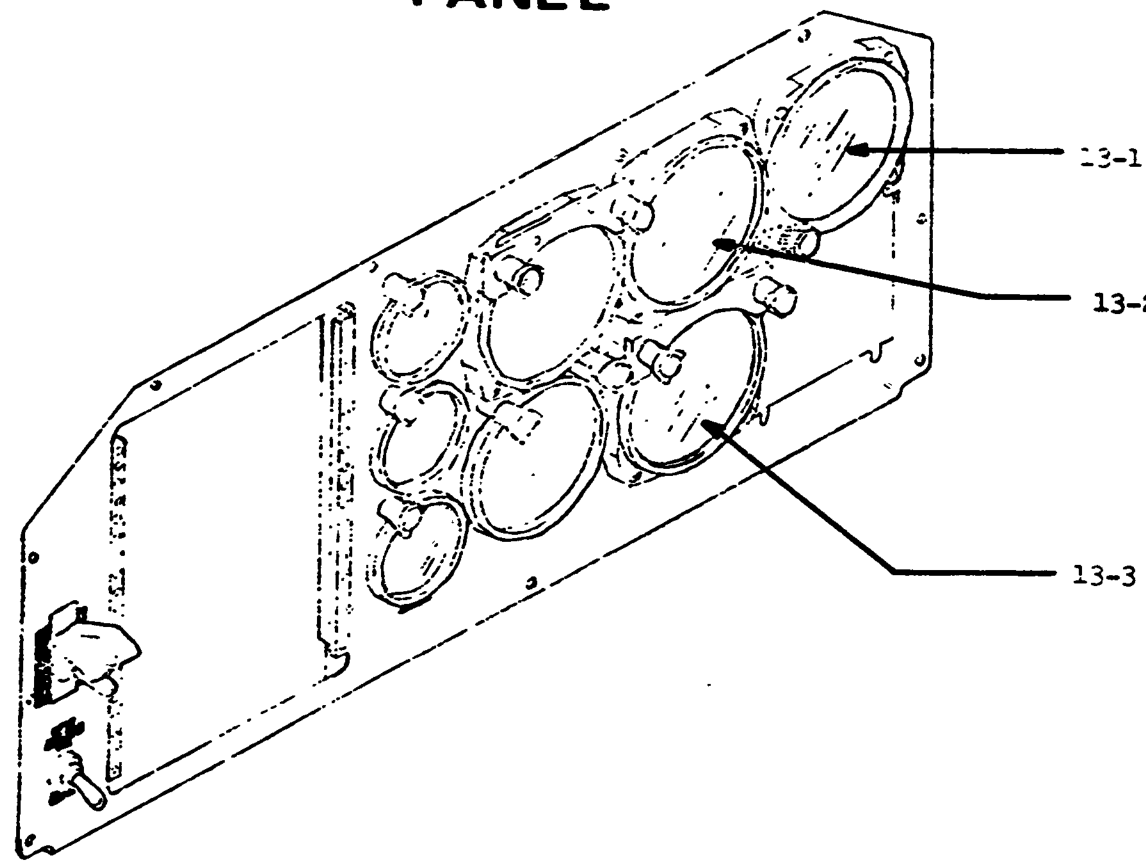


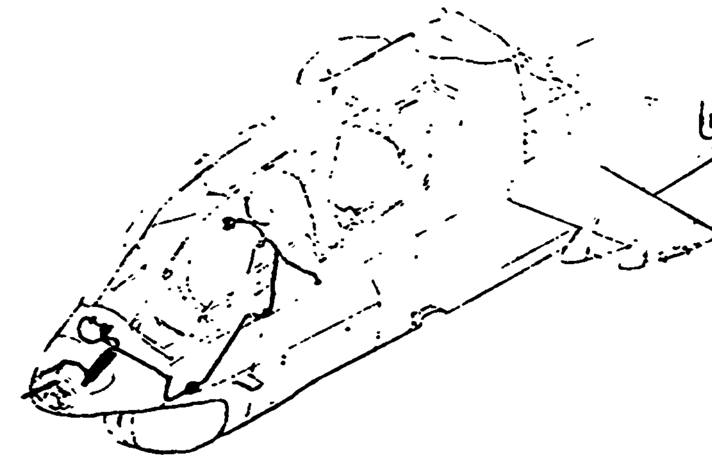
ILLUSTRATION 13

FG08
GUNNER'S INSTRUMENT PANEL



FG08

INSTRUMENT PIPING INSTALLATION



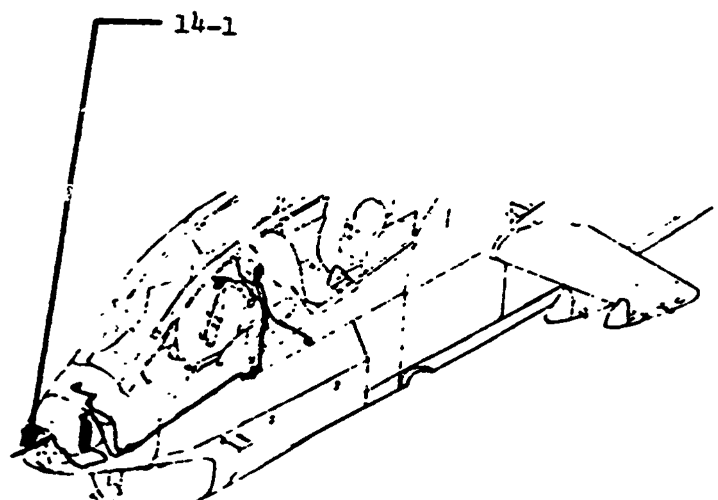


TABLE 7

FUNCTIONAL GROUP 08 INSTRUMENTS & PANELS

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
12-1	Exhaust Gas Temp Gage	42	38	1	1.4	1.4	1.0	Improp Adj
12-2	Tachometer Indicator	91	72	1	1.1	1.0	15.0	Broken
12-3	Turn & Slip Indicator	29	25	-	.86	.9	-	Not Determ
12-4	Airspeed Indicator	30	18	-	1.4	1.7	-	MWO Compl
12-5	Attitude Indicator	200	84	-	1.1	1.1	-	MWO Compl
12-6	Pressure Altimeter	16	10	1	2.6	1.0	28.5	Broken
12-7	Panel Light Fixture	28	25	1	1.1	0.9	2.5	Missing
12-8	XMSN Oil Pressure Ind	18	16	-	1.1	0.9	-	Broken
12-9	Fuel Quanity Indicator	49	39	-	1.4	1.6	-	Not Determ
13-1	Pressure Altimeter	15	12	-	1.3	1.4	-	Not Determ
13-2	Attitude Indicator	13	11	-	1.4	1.4	-	Broken
13-3	Radio Magnetic Indicator	152	32	3	0.4	0.7	1.3	No Defect
14-1	Pitot Tube	22	10	2	1.5	18.0	4.5	No Defect

FG09
FORWARD ELECTRICAL SYSTEM

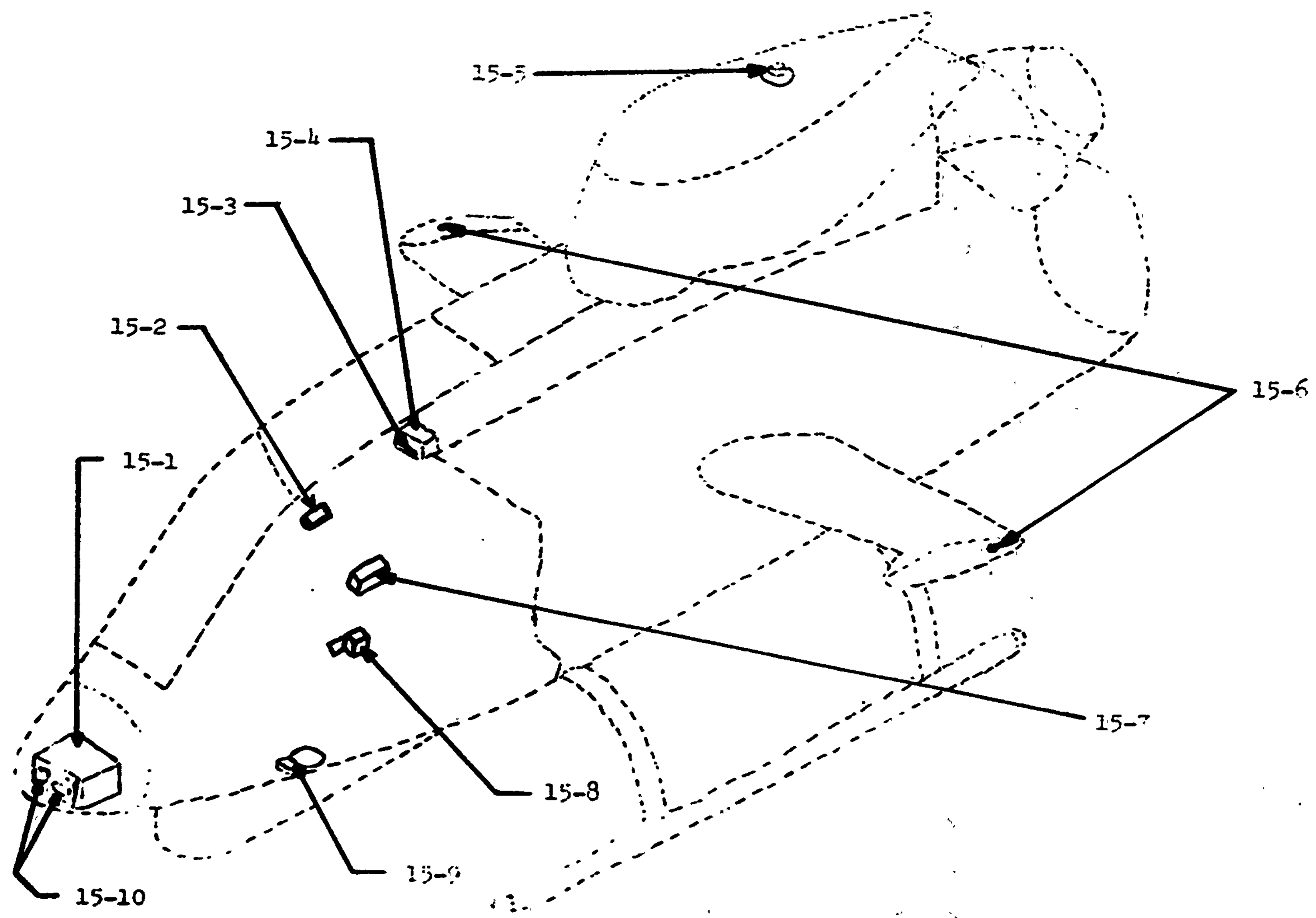


ILLUSTRATION 16

FG09
AFT ELECTRICAL SYSTEM

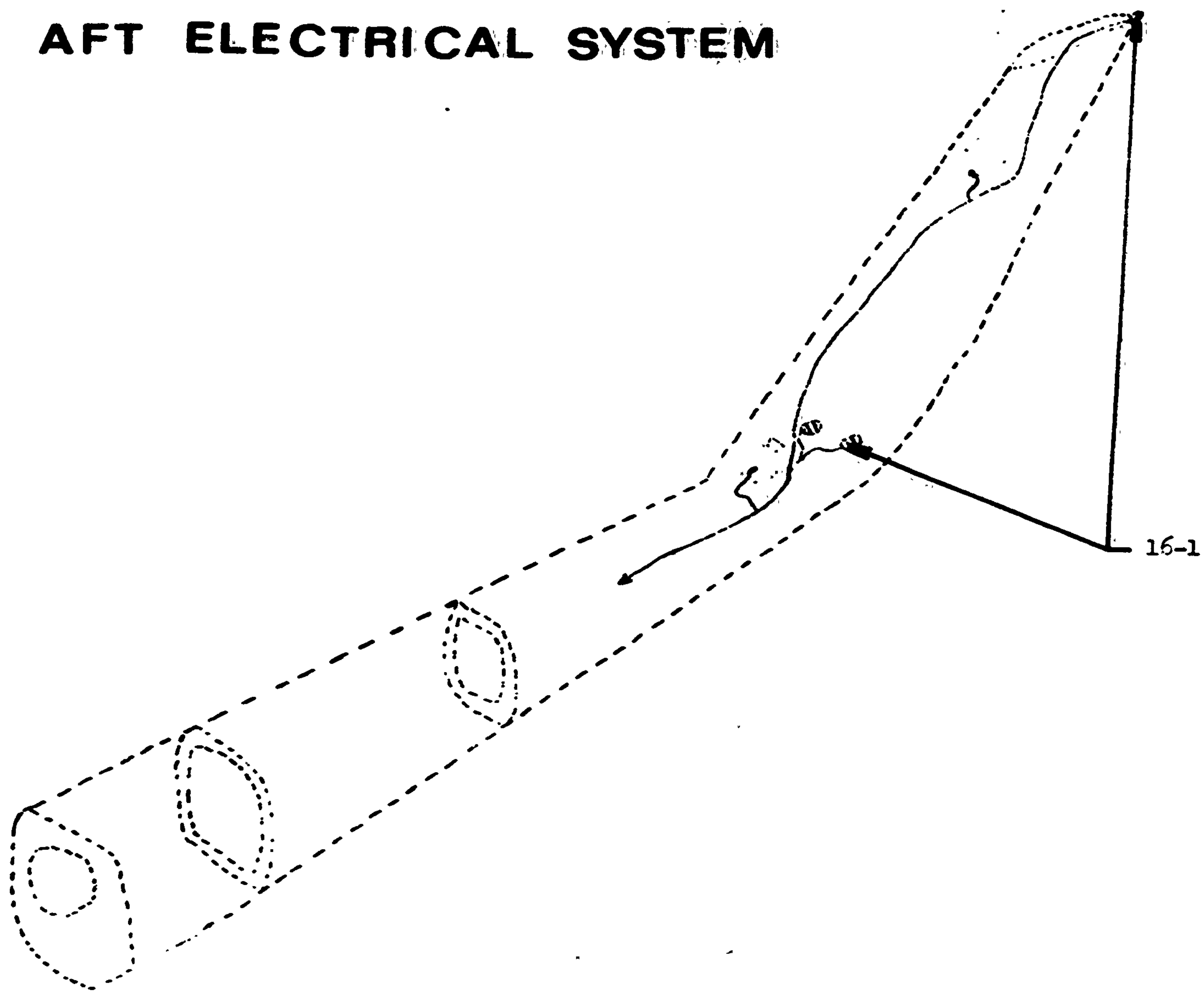


TABLE 8

FUNCTIONAL GROUP 09 ELECTRICAL SYSTEM

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
15-1	Battery	315	66	5	2.1	1.1	1.3	No Defect
15-2	Cockpit Light Assy	26	13	4	0.9	0.9	1.2	Broken
15-3	Flasher	16	9	-	1.1	1.7	-	Burned
15-4	Master Caution Panel	36	26	2	1.4	1.4	4.0	Burned
15-5	Anti-Collision Light	17	3	2	0.8	1.0	1.3	No Defect
15-6	Navigational Light	70	54	4	1.2	1.1	2.6	Broken
15-7	RPM Warning Control Box	38	25	-	1.6	1.9	-	Not Determ
15-8	Voltage Regulator	15	12	-	2.0	2.3	-	Burned
15-9	Search Light	17	15	-	2	2.2	-	Burned
15-10	Landing Light	3	2	-	0.7	1.0	-	Burned
16-1	Tail Light Assy	13	8	1	1.1	1.1	1.3	Broken

FG10
FUEL SYSTEM

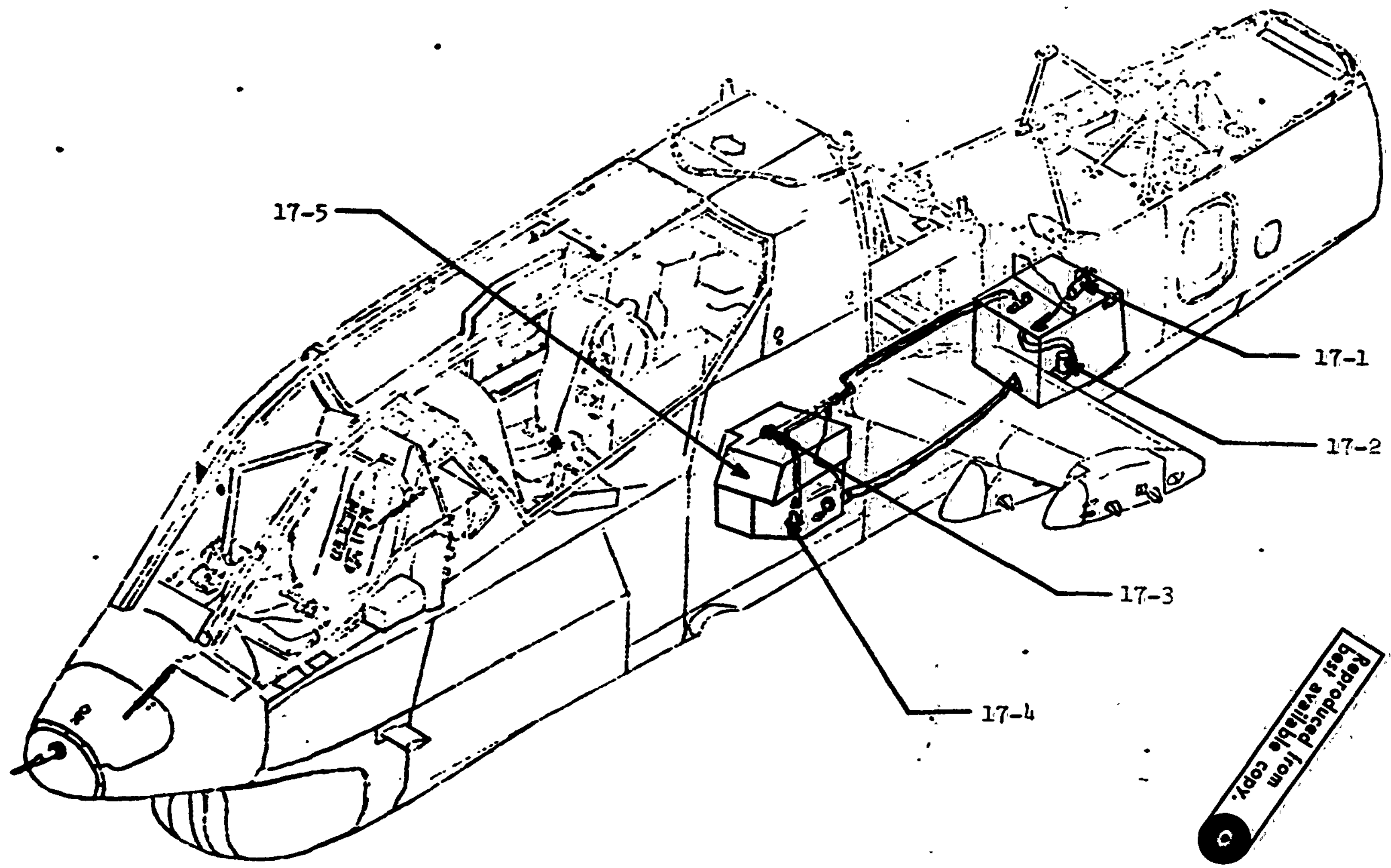


TABLE 9

FUNCTIONAL GROUP 10 FUEL SYSTEM

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
17-1	Filter Assy	72	69	-	1.4	1.5	-	No Defect
17-2	Fuel Pump Assy	25	23	-	6.78	7.2	-	Broken
17-3	Fuel Filler Cap	24	19	5	2.3	8.2	0.9	Missing
17-4	Pressure Switch	24	18	1	2	2.0	1.0	Not Determ
17-5	Fuel Tank	11	7	-	32.9	26.9	-	Broken

FG11
FORWARD CYCLIC CONTROLS

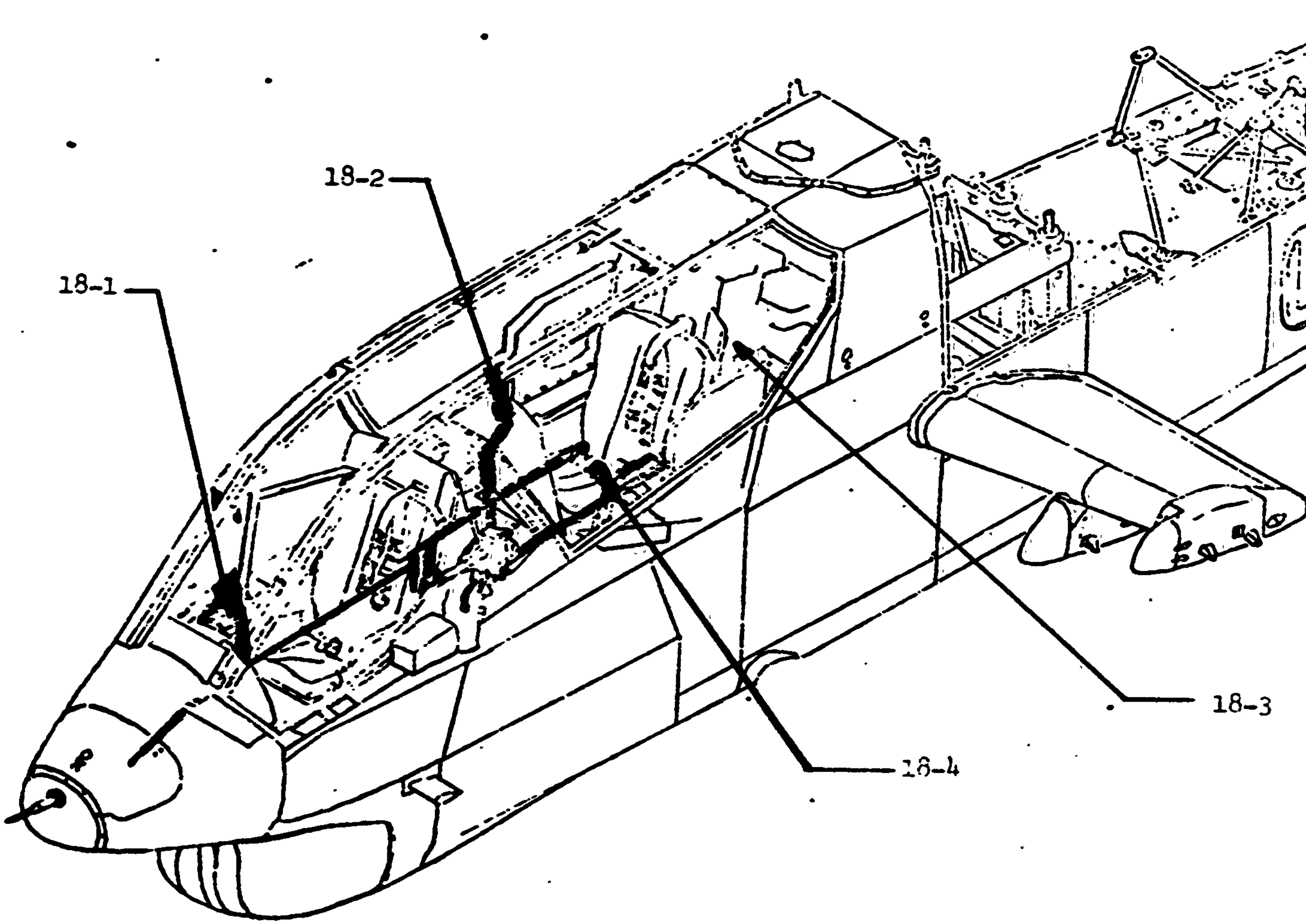


ILLUSTRATION 19

FG11
FORWARD COLLECTIVE CONTROLS

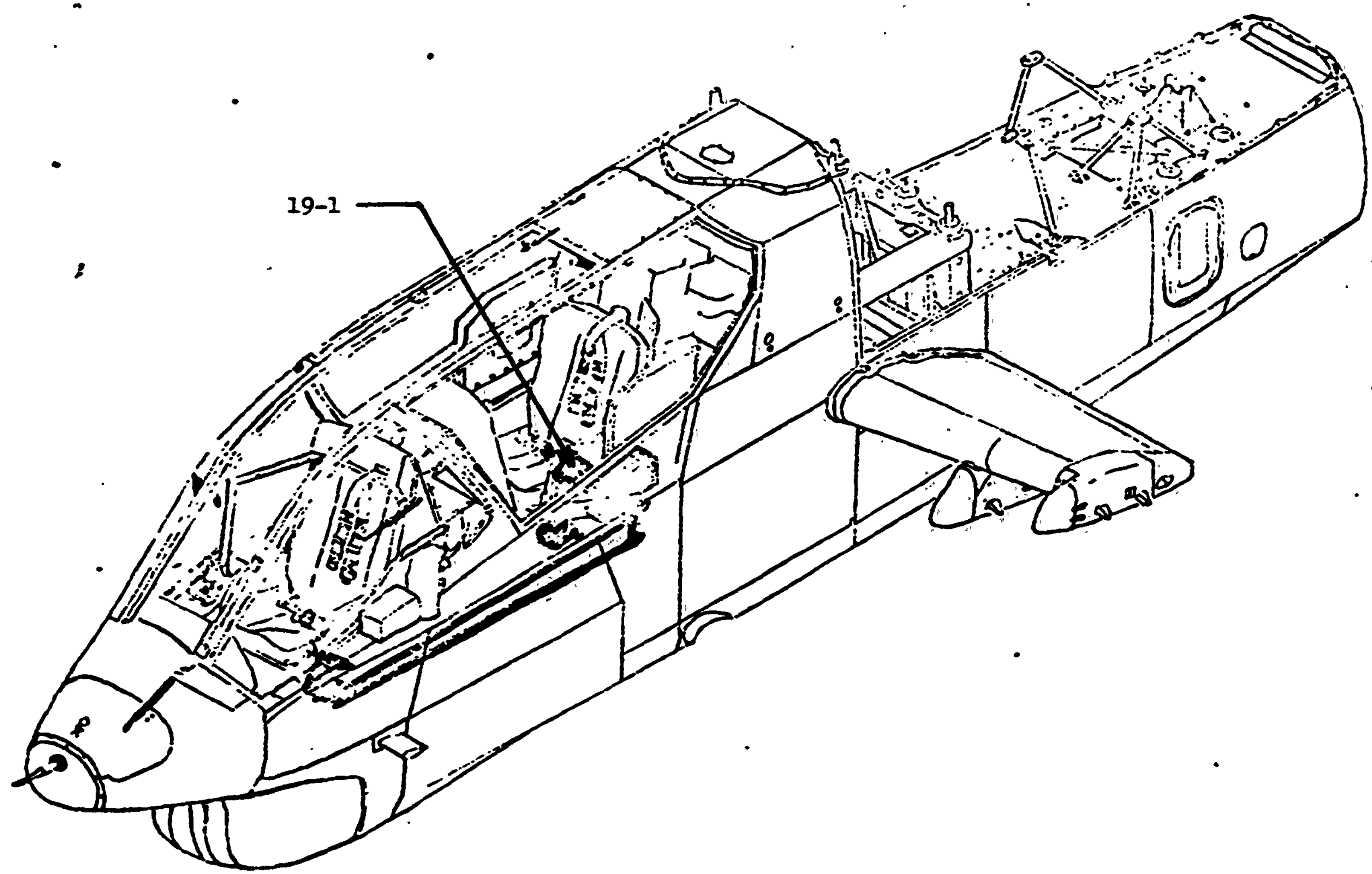


ILLUSTRATION 2?

FG 11
FORWARD ANTI-TORQUE CONTROLS

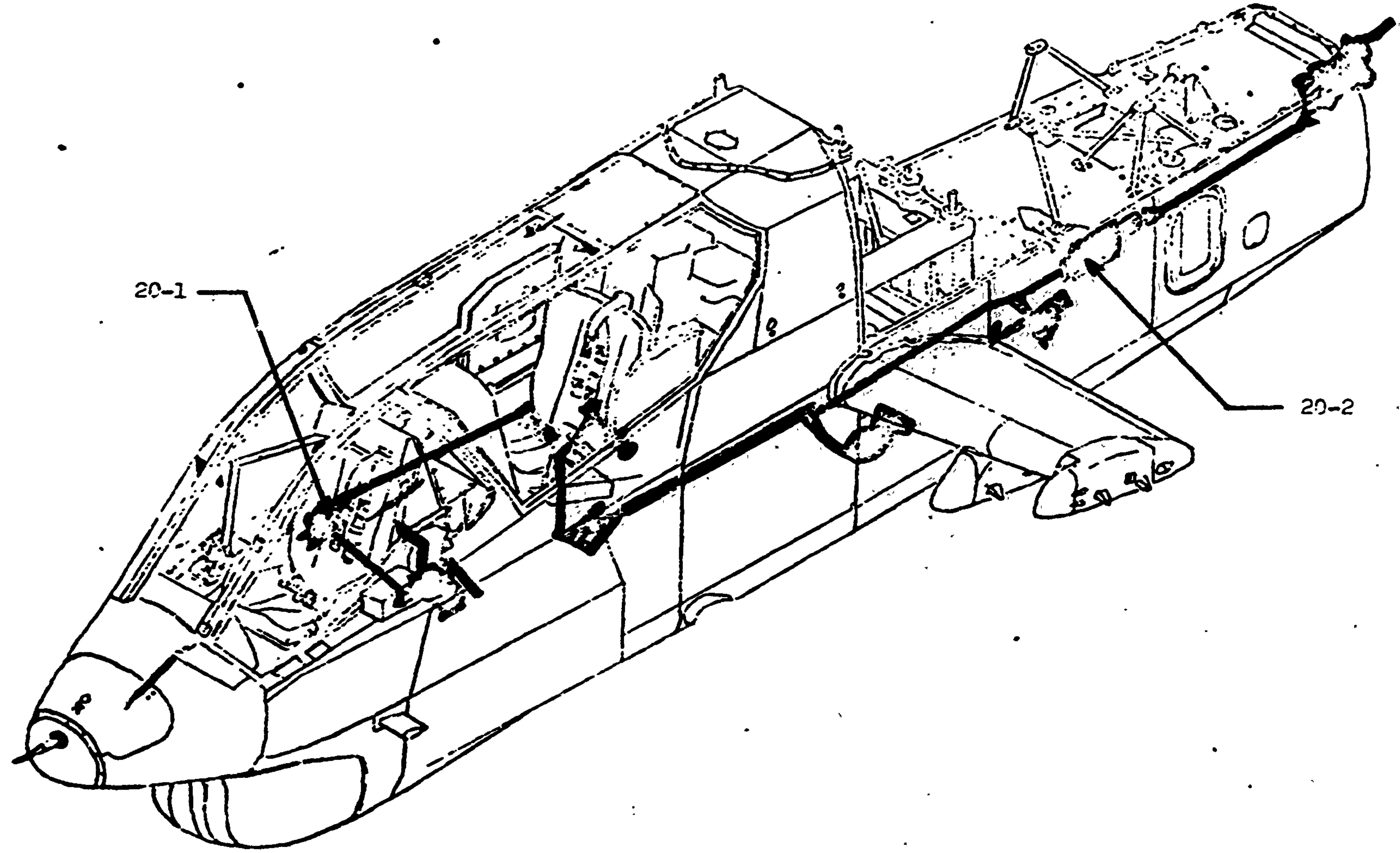


ILLUSTRATION 21

FG11
AFT ANTI-TORQUE CONTROL

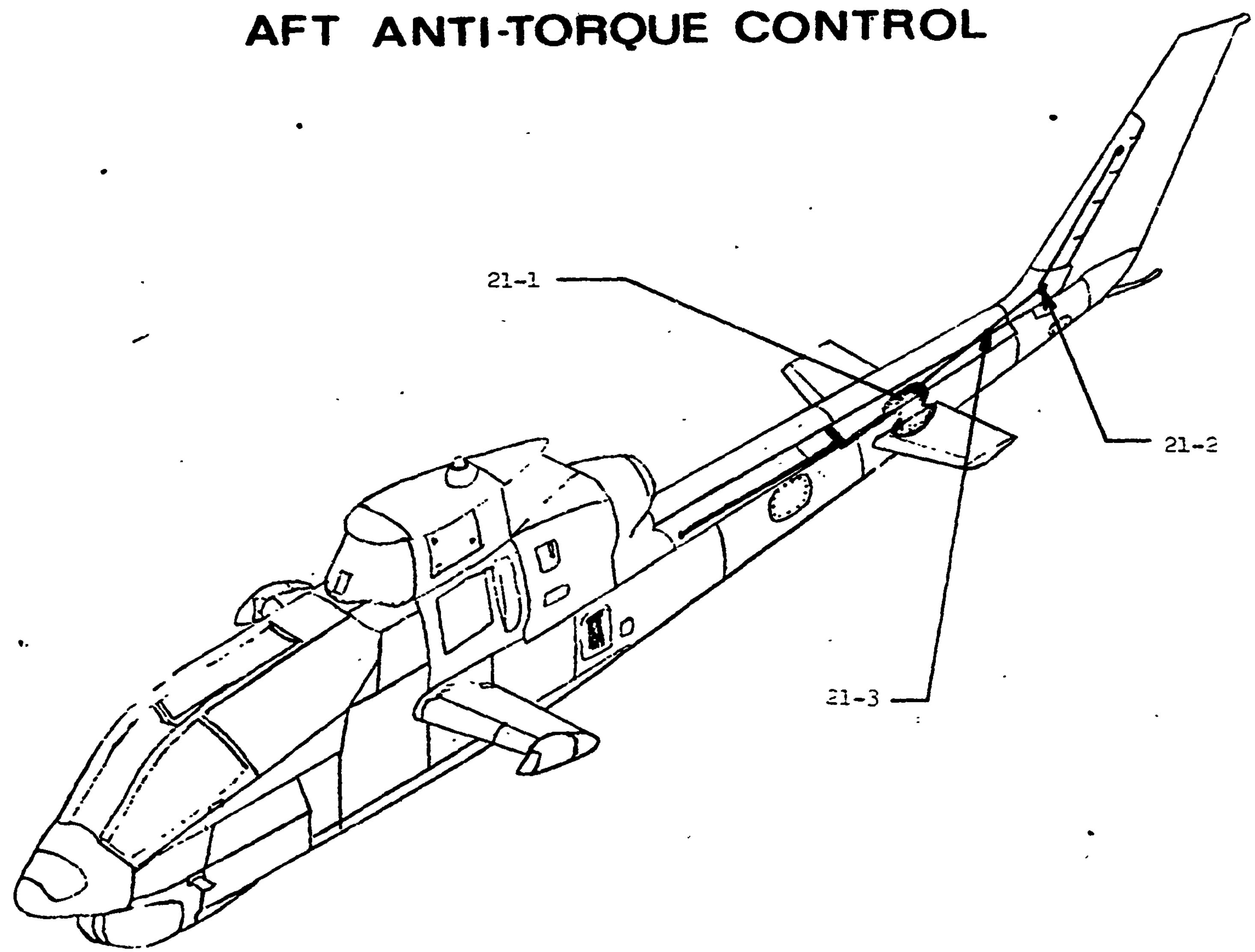


TABLE 10

FUNCTIONAL GROUP 11 FLIGHT CONTROLS

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
18-1	Gunner Cyclic Contr Stick	3	2	-	12.3	24.0	-	Broken
18-2	Pilot's Cyclic Stick	4	2	-	4.0	4.3	-	Clogged
18-3	SAS	620	17	6	0.6	0.7	3.6	No Defect
18-4	Magnetic Brake Assy	16	14	-	3.1	3.4	-	Excess Wear
19-1	Pilot's Collective Stick	5	3	-	3.3	4.8	-	Excess Wear
20-1	Force Gradient Assy	4	3	-	3.3	4.0	-	Excess Wear
20-2	Servo Actuator	35	22	1	8.4	9.0	1.0	Leaking
21-1	Quadrant Assy	7	4	-	5.1	5.3	-	No Defect
21-2	Pulley Assy	41	36	1	2.6	2.7	1.5	Excess Wear
21-3	T/R Cable Assy	211	177	-	3.5	3.7	-	Excess Wear

ILLUSTRATION 22

FG12
UTILITY SYSTEMS HEATING, & AIR VENTILATION

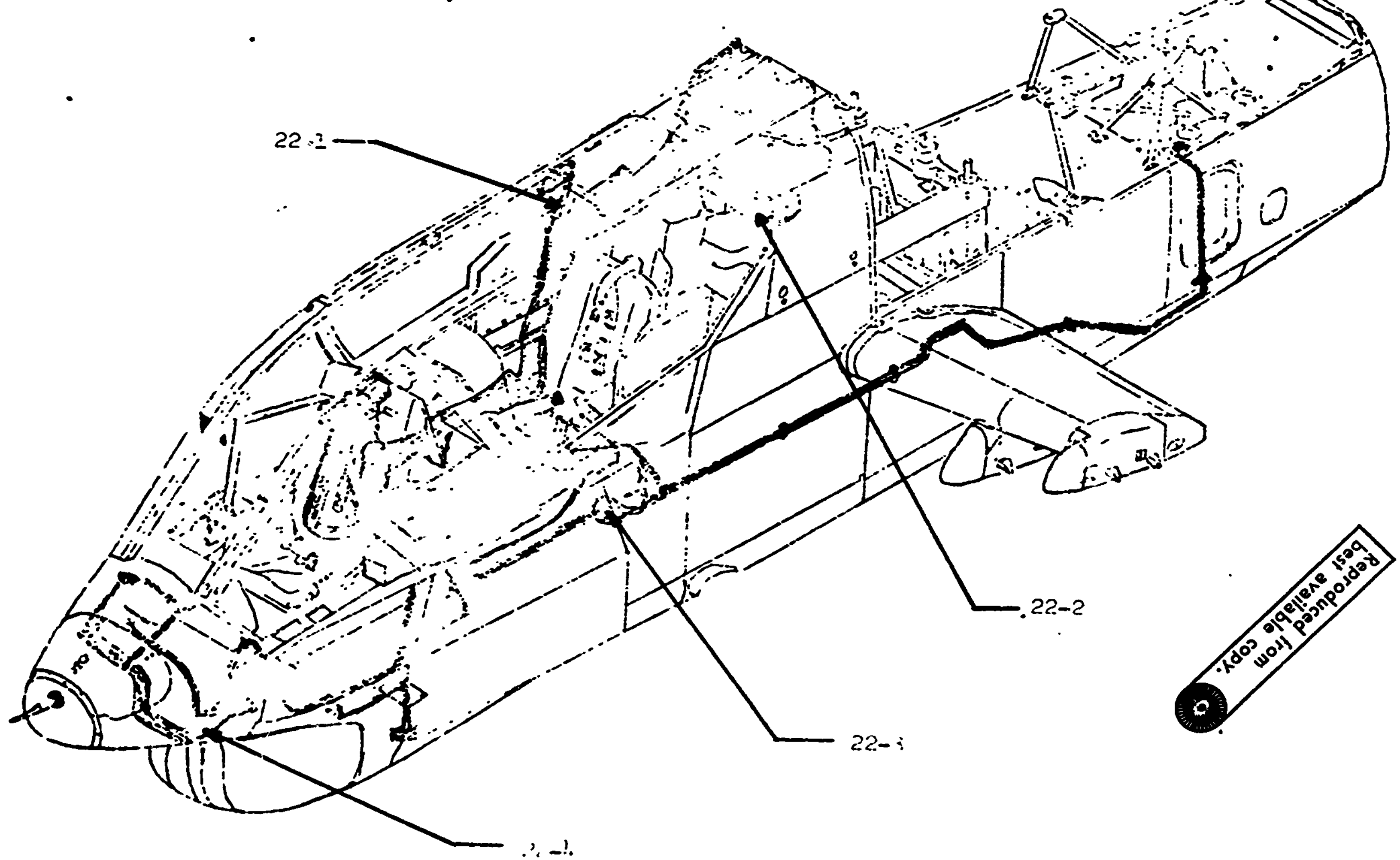


TABLE 11

FUNCTIONAL GROUP 12 UTILITY SYSTEMS

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO.	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
22-1	Air Duct Hose	31	26	3	2.2	2.4	1.0	Broken
22-2	Environmental Control Unit	107	4	2	4.2	1.6	11.0	MWO Compl
22-3	Air Valve Assy	9	7	1	2.3	2.4	4.0	Broken
22-4	Duct Assy	79	59	17	4.6	5.6	1.8	Broken

ILLUSTRATION 23

FG19
AVIONICS SYSTEM

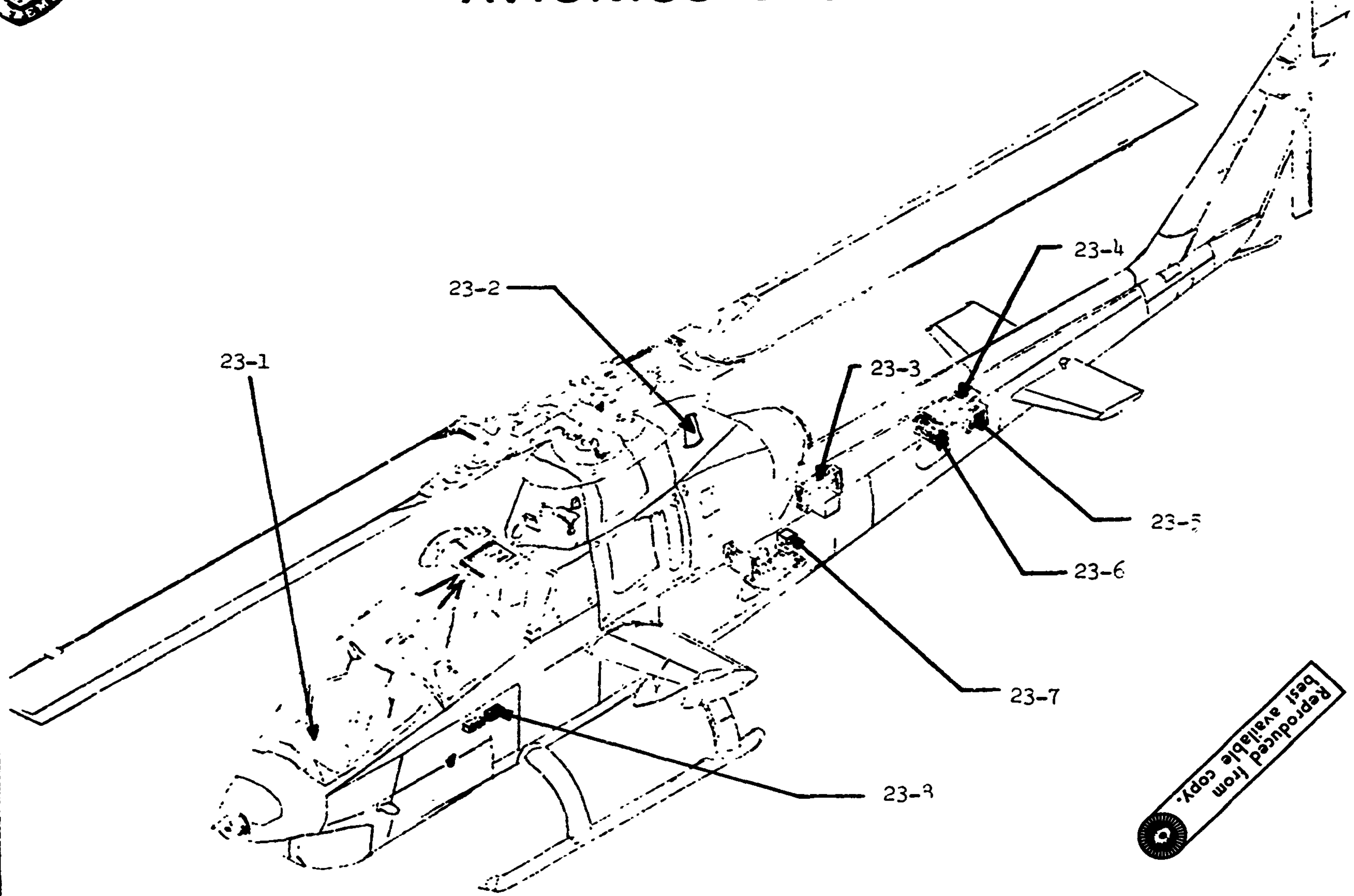


TABLE 12

FUNCTIONAL GROUP 19 AVIONICS SYSTEM

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
23-1	Floor Switch	13	4	-	0.8	1.4	-	Broken
23-2	Antenna	88	1	9	0.5	0.5	1.4	MWO Compl
23-3	Transponder	85	8	2	0.6	0.9	2.4	No Defect
23-4	FM Transceiver AN ARC 54	497	38	4	0.4	0.8	1.0	No Defect
23-5	VHF AN/ARC 134 XCEIVER	761	180	4	0.5	0.7	0.8	No Defect
23-6	UHF AN/ARC 51BX XCEIVER	724	116	5	0.5	0.8	11.9	No Defect
23-7	Gyrosyn Compass AN/ASN 43	99	21	2	1.7	1.4	3.3	No Defect
23-8	Main Inverter	105	40	-	1.9	4.0	-	No Defect

ILLUSTRATION 24

FG30 ARMAMENT SYSTEM

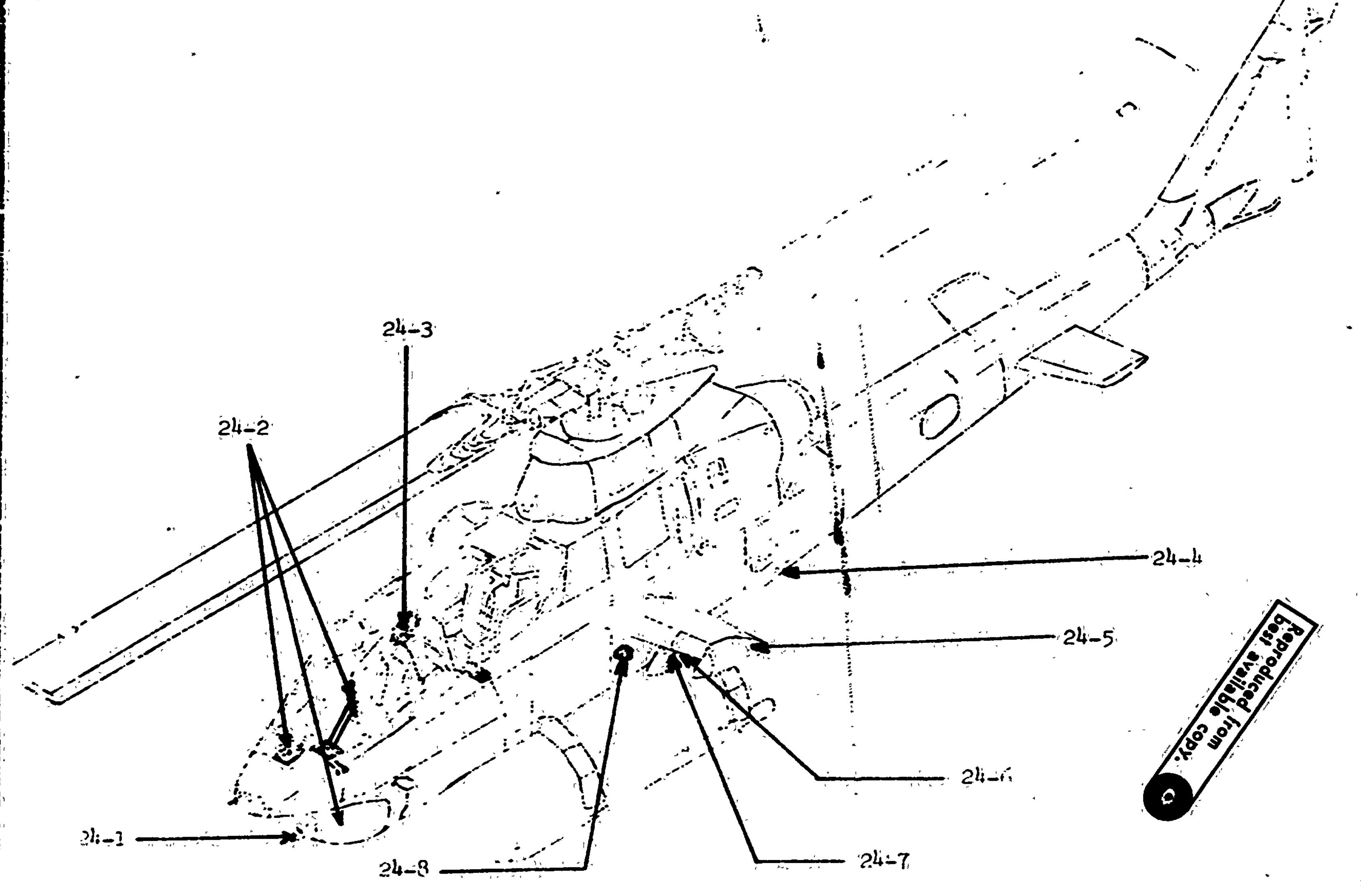
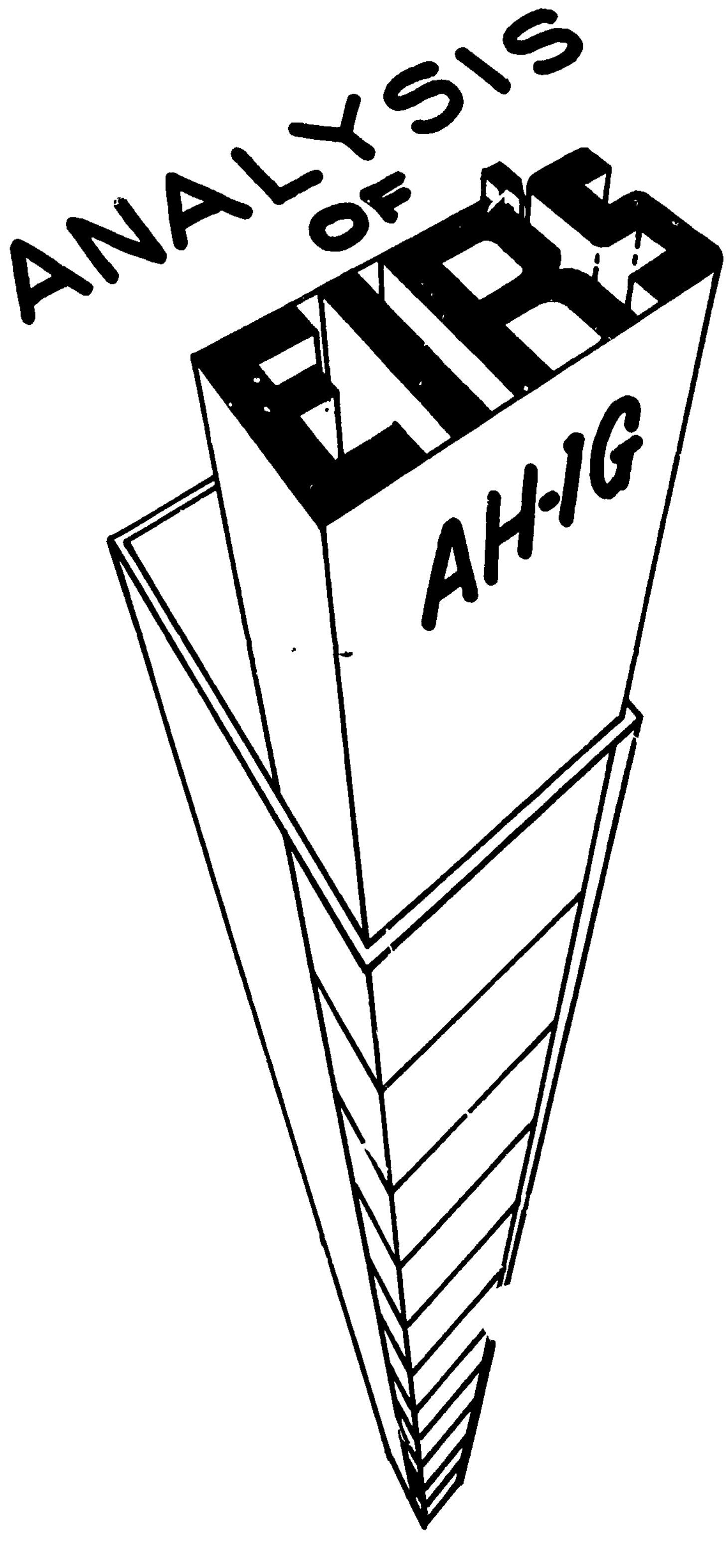


TABLE 13

FUNCTIONAL GROUP 30 ARMAMENT SYSTEM

RELIABILITY AND MAINTAINABILITY PARAMETERS FOR AH-1G

REF NO	NOUN NOMENCLATURE	TOTAL MA'S	TOTAL REPLACE	TOTAL REPAIR	AVERAGE MMH/MA	AVERAGE MMH/REPLACE	AVERAGE MMH/REPAIR	DOMINANT FAIL MODE
24-1	XM-28 Armament System	89	2	-	9.1	2.3	-	MWO Compl
24-2	TAT 102A Turret	38	2	9	3.1	7.8	2.2	Broken
24-3	Pilots Sight	11	2	1	10.6	0.8	1.0	Burned
24-4	Grenade Launcher	9	-	2	1.1	-	1.5	Broken
24-5	Rack Assy	6	1	-	1.4	6.0	-	Broken
24-6	XM-159C Armament	21	3	-	1.6	0.9	-	Broken
24-7	XM-35 Armament	76	-	1	21	-	-	MWO Compl
24-8	Intervalometer	12	4	-	3.3	4.5	-	Not Determ


ANALYSIS
OF
EIRS
AH-1G

INTRODUCTION

(U) Equipment Improvement Recommendations (EIR's) are submitted by the user when a fault or deficiency is discovered with Army equipment in the field. The nature of the EIR may involve equipment failures, defective new material, or proposed improvements in material. The object of the EIR system is to encourage field personnel to participate in the process of recommending improvements in military operational equipment for more effective utilization and performance. At the same time, the Commodity Command can utilize operational data to effect continuing engineering improvements to up-grade the items and compile a history of usage data for future development of new equipment.

There are three types of EIR's:

(1) Emergency.

(2) Urgent.

(3) Routine.

The emergency EIR is submitted on known unsafe conditions, which, if not corrected, could result in fatal or serious injury to personnel, extensive damage or destruction of valuable property, or when national security may be jeopardized.

The urgent EIR is submitted on potentially hazardous conditions that are suspected to exist, and could result in serious injury to personnel, damage to valuable property or reduce combat effectiveness. Although safety may be compromised, the risk is acceptable within reasonable limits. Finally, the routine EIR is submitted on all other conditions pertaining to equipment or procedures requiring improvement. Emergency

EIR's must be acknowledged by electrical message within 24 hours of receipt; urgent EIR's must be acknowledged by electrical message or air mail within 72 hours of receipt; routine EIR's must be acknowledged within 5 days of receipt. (Reference AVSCOM Regulation 750-28). AMC Regulation 750-3 requires that Emergency and Urgent category EIRs be answered within 30 days and that Routine type be answered within 150 days. The distinction between acknowledging and answering an EIR is that acknowledgement merely involves telling the initiator that the EIR has been received, while the latter conveys the information concerning what action, if any, is being taken to resolve the problem. Further details of the EIR system are presented in Appendix A.

This chapter first presents an accounting and categorization of those EIR's received during the reporting period. The chapter then proceeds to evaluate that portion of the total that was assigned to cases. This evaluation includes a detailed analysis of emergency EIR's, an analysis with respect to functional group and an analysis of the particular components by part number.

EIR CASE FILES

Any single EIR or group of related EIRs which reflect a significant isolated or recurring problem with equipment failures, defective new material, inadequate technical publications or environmental deterioration will normally be classified into an EIR case file. When a case file is evaluated and processed for investigation, all outstanding EIRs are compared to the case file for similarity. After final actions and dispositions are taken for each investigation, the EIR becomes a part of the case file.

These files are then maintained for future use to provide answers to open case investigations and evaluate past problem history with the equipment. Each case number consists of a functional group code; the appropriate failure code and the part number of the item reported as defective, failed or requiring improvement by the field activities.

ACCOUNTING

The first portion of this chapter addresses the question of accounting for those EIR's received against the particular fleet of aircraft being analyzed. The value in documenting this type of information lies not in the mere presentation of numbers but rather in evaluating the credibility of the entire EIR system. Higher headquarters have recently been placing considerable significance on EIR accountability. A comprehensive automated computer program has been developed to handle the accounting of EIR's. This program is currently being revised, therefore, the following tables contain only a limited amount of information. They do, however, indicate the type of information which will be available.

Table 1 is concerned only with those EIR's received during a given quarter. It segregates these EIR's into those assigned or not assigned to cases and those answered or not answered, again within the given quarter. These EIR's are also sub-categorized according to type (emergency, urgent, or routine), month and responsible action office. For those EIR's answered within the quarter, the method of answer is also displayed.

Table 2 presents a summary of unanswered EIR's. It gives the backlog existing on the first day of the given quarter, EIR's received this quarter and not answered, past EIR's answered within the quarter, and the present backlog of unanswered EIR's on the last day of the accounting quarter. All of these displays are again categorized according

TABLE 1

FLEET QUARTERLY SUMMARY

PERIOD COVERED FROM 1 JAN 1972 TO 31 MARCH 1972

EIR'S RECEIVED THIS QUARTER

			ACTION OFFICE														
			AH-1G BR SYS ENG			POWER PLANTS			GENERAL ITEMS			PRODUCT ASSURANCE			OTHER		
	TYPE	QUARTER TOTAL	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar
EIR'S RECEIVED THIS QUARTER	EMER																
	URG																
	ROUT																
	TOTAL																
EIR'S NOT ASSIGNED TO CASES	EMER																
	URG																
	ROUT																
	TOTAL																
EIR'S ASSIGNED TO CASES	EMER	3	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0
	URG	36	4	9	6	4	4	9	0	0	0	0	0	0	0	0	0
	ROUT	215	81	62	39	9	11	5	0	1	0	3	3	0	0	0	1
	TOTAL	254	85	72	46	13	16	14	0	1	0	3	3	0	0	0	1
EIR'S NOT ANSWERED	EMER																
	URG																
	ROUT																
	TOTAL																
EIR'S ANSWERED	EMER																
	URG																
	ROUT																
	TOTAL																
	LTR																
	TWX																
	OTHER																

TABLE 2

SUMMARY OF UNANSWERED EIR'S
PERIOD ENDING 31 MARCH 1972

				ACTION OFFICE														
				AH-1G BR SYS ENG			POWER PLANTS			GENERAL ITEMS			PRODUCT ASSURANCE			OTHER		
		TYPE	TOTAL	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar
BACKLOG UNANSWERED EIR'S AT BEGINNING OF QUARTER		EMER																
		URG																
		ROUT																
		TOTAL	173	153			5			2			11			2		
EIR'S RECEIVED THIS QUARTER AND NOT ANSWERED		EMER																
		URG																
		ROUT																
		TOTAL																
PAST EIR'S ANSWERED THIS QUARTER		EMER																
		URG																
		ROUT																
		TOTAL																
TOTAL PRESENT BACKLOG OF UNANSWERED EIR'S	0-30 DAYS	EMER	0			0			0			0			0			0
		URG	0			0			0			0			0			0
		ROUT	1			1			0			0			0			0
	31-60 DAYS	EMER	0			0			0			0			0			0
		URG	0			0			0			0			0			0
		ROUT	0			0			0			0			0			0
	61-90 DAYS	EMER	0			0			0			0			0			0
		URG	0			0			0			0			0			0
		ROUT	0			0			0			0			0			0
	91-120 DAYS	EMER	1			1			0			0			0			0
		URG	0			0			0			0			0			0
		ROUT	8			8			0			0			0			0
	121-150 DAYS	EMER	0			0			0			0			0			0
		URG	0			0			0			0			0			0
		ROUT	8			8			0			0			0			0
	151-180 DAYS	EMER	2			2			0			0			0			0
		URG	0			0			0			0			0			0
		ROUT	11			11			0			0			0			0
	Over 180 DAYS	EMER	0			0			0			0			0			0
		URG	1			1			0			0			0			0
		ROUT	12			12			0			0			0			0
	TOTAL		44			44			0			0			0			0

to type, month, and action office. The present backlog is also categorized according to 30 day time periods for not answering EIR's.

A third table presenting a summary of unassigned case numbers will also be available soon. It will contain displays similar to those in the summary of unanswered EIR's. The modified program will also account for EIR's that are administratively closed as well as EIR's that have been transferred from one action office to another.

EMERGENCY EIR'S

COMMAND STATUS

The Directorate for Product Assurance, Systems Performance Assessment Division, Assessment Methodology Branch (AMSAV-LSA) maintains the automated data bank for accumulation and control of the EIR report program. In this same area of responsibility, registers are maintained for Emergency EIR's submitted from the field by electrical message and the mail-in copies of the DA Forms 2407. Using this centralized control of the EIR's received and assigned to the various action offices, a large display board was designed to indicate status of Emergency EIR's in the Command Operations Center (COC). This board is located in the COC room on the 5th floor adjacent to the message center. The register of these EIR's is provided for daily review by Command elements and interested action officers to indicate the most current actions or interim instructions to the initiator of these EIR's. Daily visits are made by personnel from AMSAV-LSA to up-date this Emergency EIR status board and to advise the COC office staff of all actions taken to resolve these reports in a timely manner.

TECHNICAL EVALUATION

A review of the EIR Data Bank was performed to determine how many EIRs received during calendar year 1972 were classified as Emergency category. The register for electrical message or TWX transmitted EIRs listed one and the register for mail-in copies contained four emergency

EIRs. Copies of these reports were obtained and studied to find any weakness in the system for processing the emergency EIRs. The study was approached to look at each EIR report and to analyze the initiator's description of the problem and evaluate the user experience with the equipment. The investigation and subsequent disposition of each case, as furnished by the responsible action office, was not questioned during this study. The results of the analysis of the five EIRs mentioned above, together with specific observations, are listed in the following paragraphs:

a. Emergency EIR (TWX): 1332154. (See Figure 81 attached)

(1) Subject: Cosmoline (Preservative Grease) Found in Main Rotor Hub Trunnion.

(2) Initial Action: Downgraded to routine category per TM 38-750.

(3) Investigation: Continuing at ARADMAC by Directorate for Research, Development and Engineering.

(4) Disposition: Interim instructions were sent to the field for the cleaning, inspecting and subsequent use of these hubs and/or bearings. It is suspected that the grease will attack and soften the teflon bearings.

(5) Observations: This discrepancy is adequately reported and described in EIR case number PG-04-095-540-011-110-9-13, which contains four EIR's and case number PG-04-095-540-011-110-5, which contains thirteen EIR's. The first case concerns bearings installed in main rotor head assemblies with grease during overhaul at ARADMAC. The second case concerns bearings improperly preserved in grease during overhaul at Spartan Aircraft in

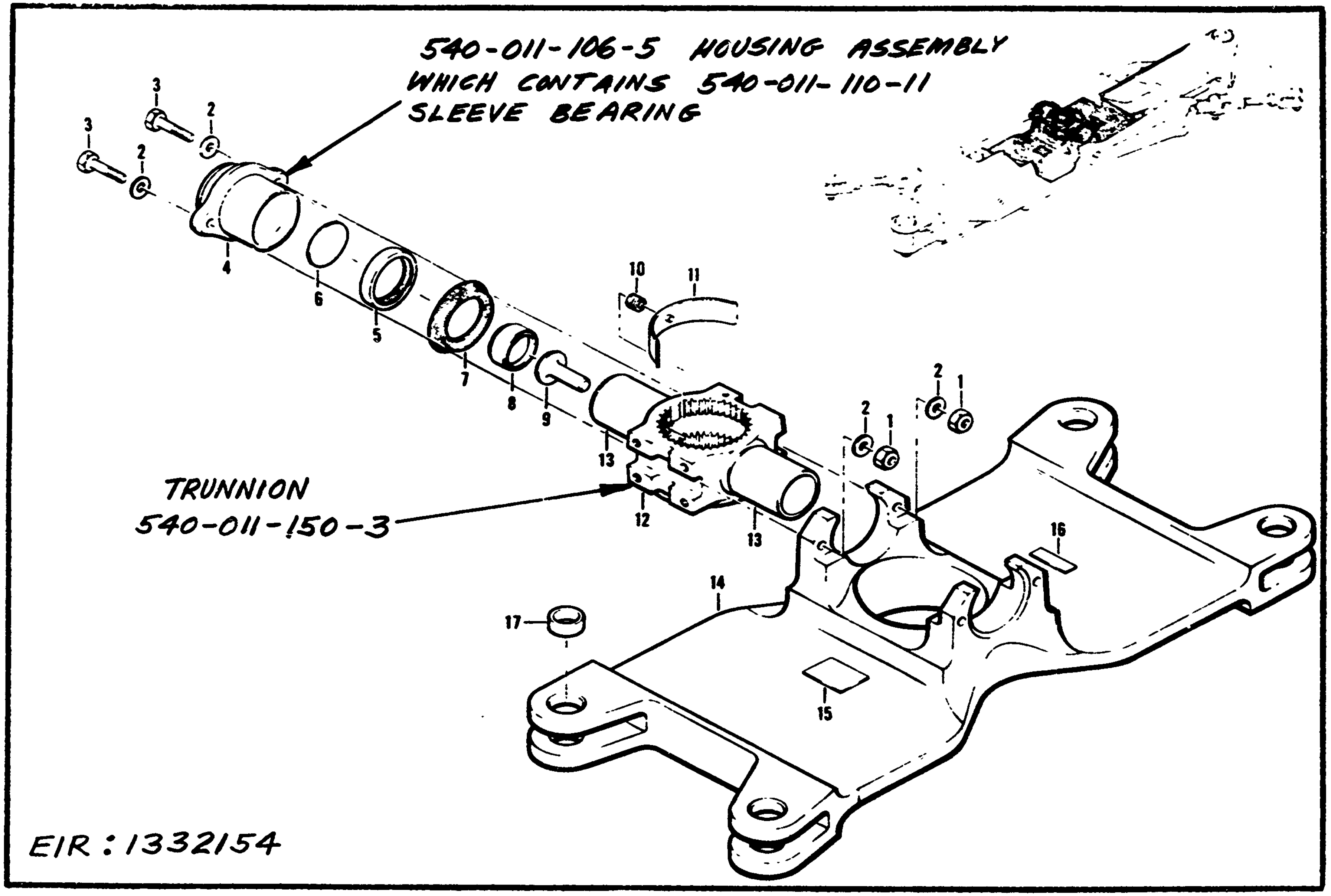


Figure 81. Hub Assembly, Main Rotor

Tulsa, Oklahoma, on contract DAAJ01-70-D-0090 during June and July, 1971. Many other bearings were received from Army supply depots, new and not installed in main rotor hubs, which were improperly preserved by the contractor who supplied the bearings to the Army. These particular bearings were not supplied by the prime aircraft manufacturer (Bell Helicopter Company).

b. Emergency EIR: 120545. (See Figure 105 attached).

(1) Subject: Cracked Boot on Transmission Input Shaft.

(2) Initial Action: Downgraded to routine category EIR per TM 38-750.

(3) Investigation: Closed.

(4) Disposition: The field has been notified that a new type seal is being manufactured for replacement.

(5) Observations: This problem was reported in EIR case number PG-04-117-205-040-004-3, concerning deteriorated seals on the drive shaft assembly. There were two EIR's in this case folder and the manufacturer of the rubber boot was identified as the Lord Manufacturing Company. Another cross referenced file, EIR case number PG-04-947-205-040-176-1, concerning torn drive shaft boots, contained thirty-five separate EIR's and one Equipment Performance Report from Fort Rucker, Alabama. All of these reports were written describing the rubber boot as cracked, torn, punctured with holes, separating, deteriorating and permitting the grease and/or lubricant to be slung inside the cowling of the aircraft.

c. Emergency EIR: N05749. (See Figure 84 attached).

(1) Subject: Stud, P/N AN -126366 Broken in Transmission Case.

(2) Initial Action: Downgraded to routine category EIR per TM 38-750.

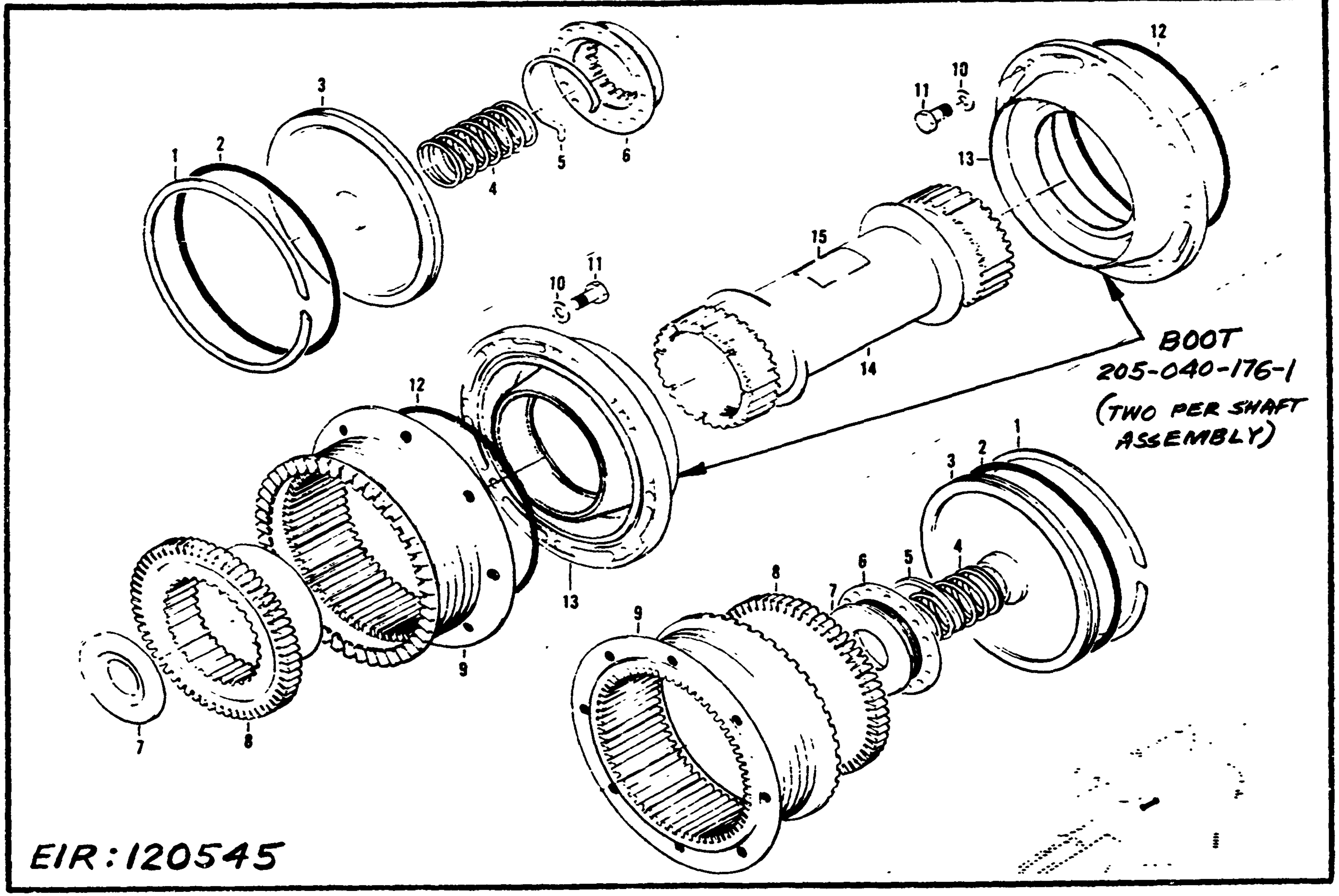


Figure 105. Drive Shaft Assembly

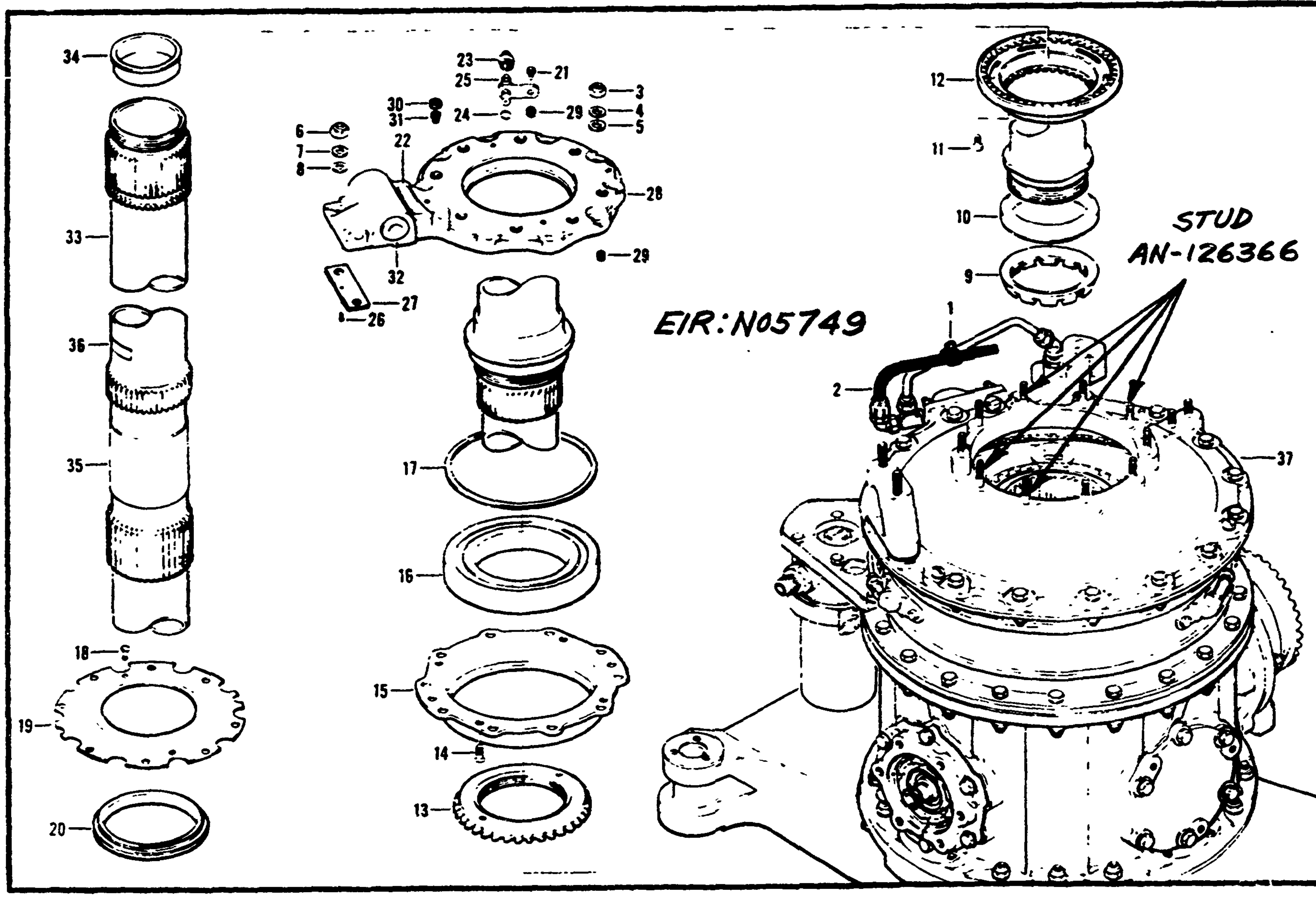


Figure 84. Transmission and Mast Assembly

(3) Investigation: Continuing.

(4) Disposition: Unknown at this time.

(5) Observations: The TM-55-1520-221-34P, figure 87, item 17, indicates use of the AN-125366 standard stud for this installation as stated in the EIR. It is important here to note that there are also four (4) other studs listed in the technical manual, oversize from .003 to .012 inches, that are used for those applications where a larger thread is required during overhaul or repair of the case. It is possible that these studs were not installed correctly during overhaul by application excessive of torque loads; improper use of impact wrenches to torque the studs; or material in the studs not in accordance with the specification requirements.

d. Emergency EIR: N17759. (See Figure 54 attached).

(1) Subject: Crosstube, P/N 209-250-002-45 is Cracked.

(2) Initial Action: Downgraded to urgent category per TM 38-750.

(3) Investigation: Completed.

(4) Disposition: Project closed.

(5) Observations: This type of a defect has been reported previously in EIR case number PG-02-070-209-050-002-45, concerning broken forward crosstubes found in three different EIR's. None of the failures were similar in nature or occurrence. EIR case number PG-02-190-209-050-003, contained five EIR's reporting cracked crosstube fairing assemblies. These are made from a plastic or fiberglass material which has been cracking after maintenance personnel use these as a step to support themselves while working on the aircraft. Another EIR case, number PG-01-190-209-050-003

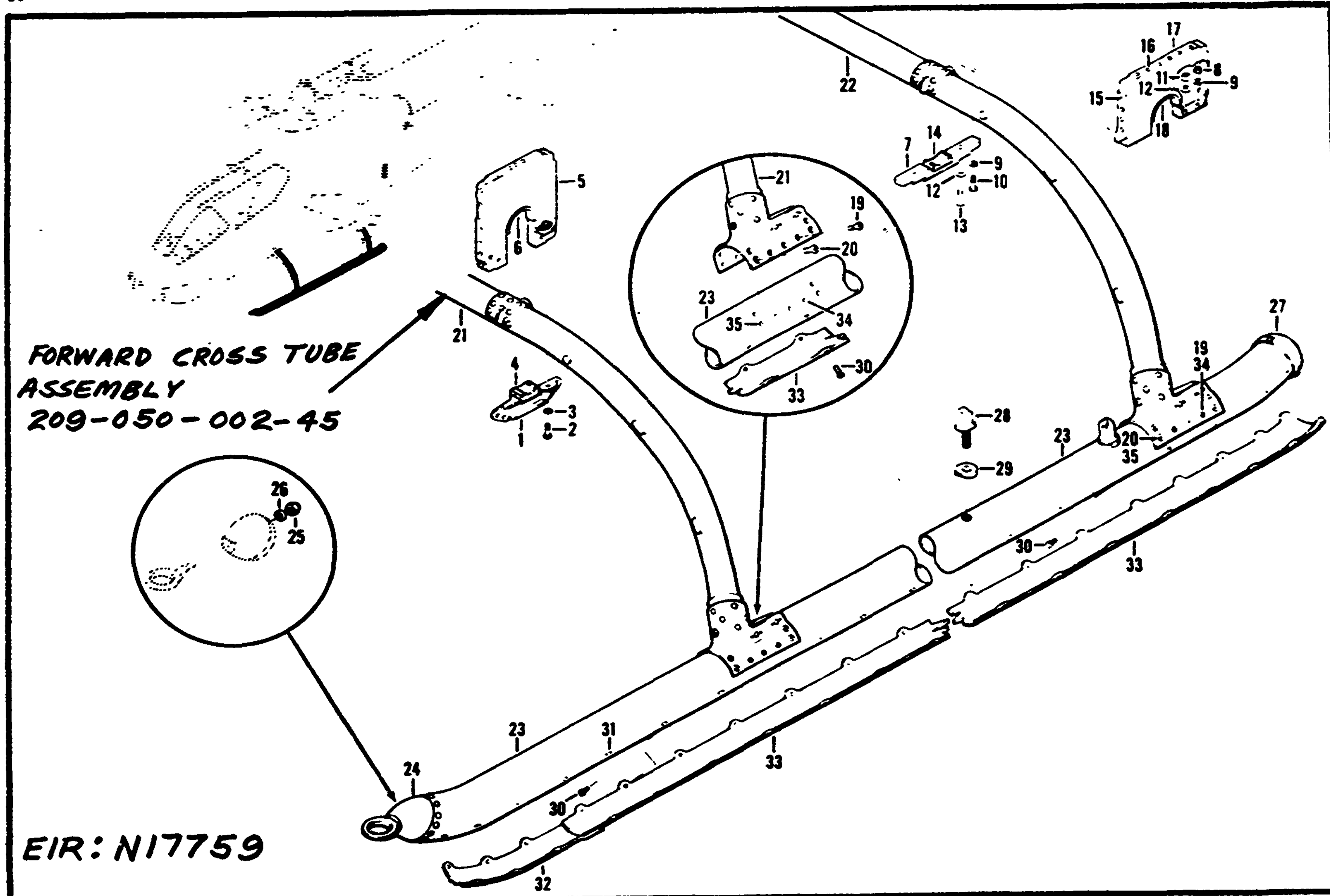


Figure 54. Support Installation, Left-Hand

contained a similar complaint in an Equipment Performance Report from Fort Rucker, Alabama. Broken crosstube assemblies were found in two EIRs submitted under case number PG-02-070-209-050-007-45. These crosstubes were broken next to the saddle area and one contained a crack about six inches above the skid. A cracked section of tube was forwarded to AVSCOM for analysis from a similar incident. The broken section of the crosstube from this EIR report was requested in AVSCOM's reply to the field. Inspection criteria was provided in the reply to permit the user to find any other defects in these tubes and replace them where required. This EIR was transmitted to AVSCOM on 26 Sep and the final answer was sent back by 18 Oct 71.

e. Emergency EIR: R45547. (See Figure 46 attached).

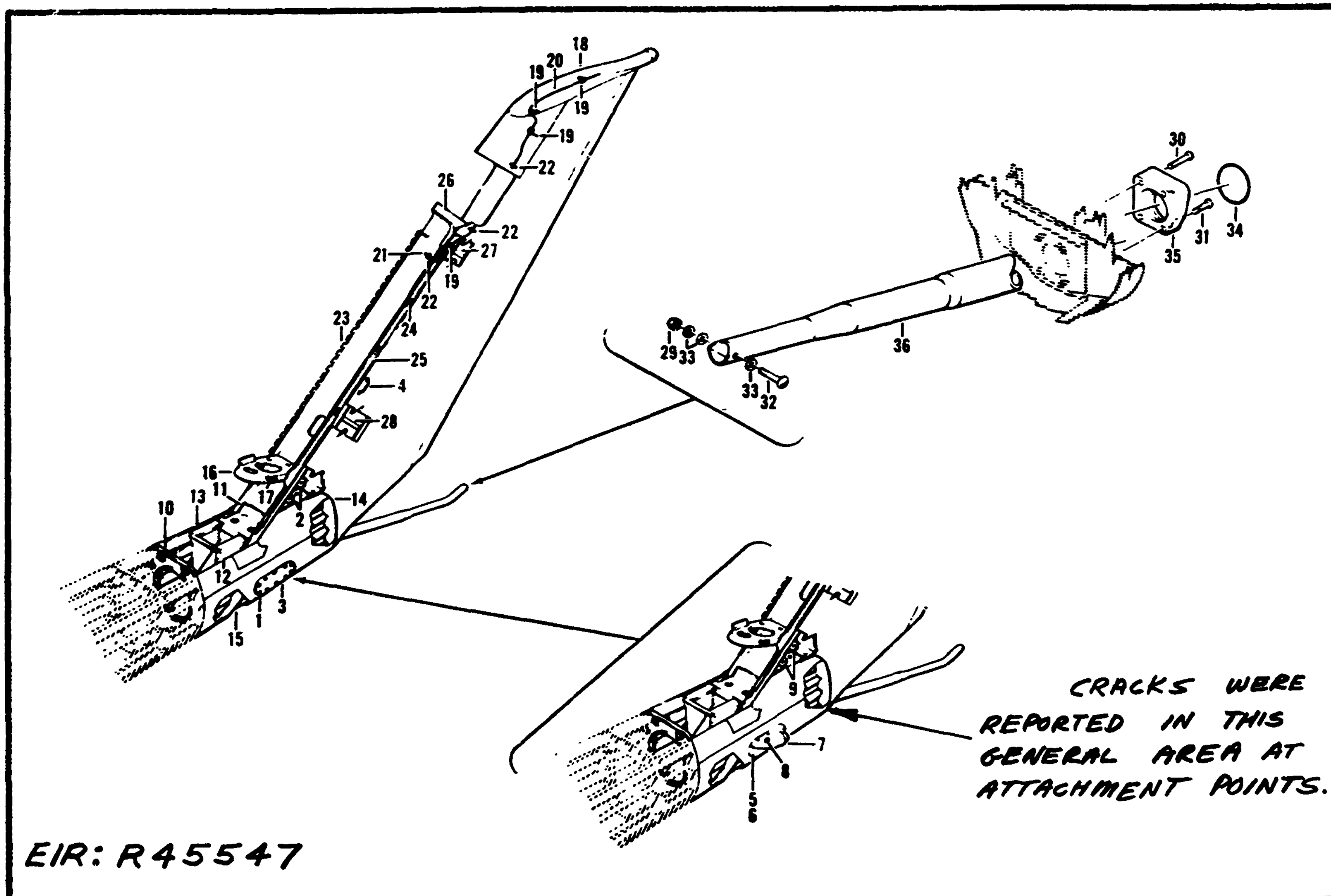
(1) Subject: Cracked in Tailboom, P/N 209-010-700-1.

(2) Initial Action: Downgraded to routine category per TM 38-750.

(3) Investigation: Continuing.

(4) Disposition: Interim instructions sent to the initiator requesting the part number be corrected and a more accurate location and description of the cracked area. It was suggested that a photograph be included with a resubmittal of the EIR.

(5) Observations: The initiator of the EIR used the part number for the tail rotor installation; an improper Federal Stock Number, and wrote the discrepant condition against the tail boom. In paragraph 11, on page 2 of the EIR, the cause is described as follows: "Failure or crack in V (vertical) fin, left side of tail." A sketch was attached to the EIR indicating that the crack was at a location behind the tail rotor gear



238 Figure 46. Fin Installation

box somewhere between the aft end of the tail boom splice line and the forward attach point of the vertical fin. The descriptive information was too confusing to determine where the crack existed and more detailed information was required. No previous case files were in existence.

f. The register of Emergency EIR's prepared by the Directorate for Product Assurance, Systems Performance Assessment Division, Assessment Methodology Branch (AMSAV-LSA) contained thirty Emergency category EIR's for the first quarter of calendar year 1972. Of these, five were written for problems with the AH-1G aircraft. One EIR assigned to the Powerplants action office was not assigned to any aircraft system but further research revealed EIR N08606 was initiated for an internal failure of a T53-L-13B turbine engine on the UH-1H aircraft. This EIR was carried over into this report since the T53-L-13B engine can also be used on the AH-1G; and in the Major Items Chapter the same turbine engine is included in the list of major items that can be improved. A separate Major Items Special Study (MISS) report for the UH-1H and the AH-1G reveal the dominant failure mode for the turbine engines to be internal failures. From this data reported by the field and subsequently analyzed for these reports in the area of reliability and maintainability, the family of turbine engines on these TMS fleets deserve intensive actions to remedy these failure conditions.

FUNCTIONAL GROUP ANALYSIS

The following section presents an analysis of EIR's by functional group. Illustration 1 shows the distribution of EIR's by functional group for the current quarter versus the two-year period. Note that the dynamic components of the Rotor, Transmission System/Clutches group continue to perform poorly as they did in previous summaries, and the Powerplant and Related Systems group continues to occupy the next highest failure level.

Illustration 2 shows the three most frequent failure modes for each functional group. The "bearing failures" reported by EIRs for the Rotor and Drive System appear to be consistent with the failure mode analysis obtained from the DA Form 2410 (TAMMS) reporting system. The predominance of "internal failures" in the Powerplant System continues to highlight this repetitive problem with the T53-L-13 turbine engines.

Table 2 is presented to show a trend in the number of EIR's submitted during this quarter versus the number submitted in the previous report. Note that the trend is still upward for Rotor, Transmission System and Power-plant functional groups while the other three groups fall into a sharp decline in relation to the number of EIR's being written on each system.

ILLUSTRATION 1

BREAKDOWN BY FUNCTIONAL GROUPS OF EIR'S ASSIGNED TO CASES FOR THE AH-1G FLEET DURING THE TWO YEARS ENDING 31 MAR 1972

EIR'S BY FUNCTIONAL GROUP FOR THE LAST QUARTER AND TWO YEAR PERIOD

FUNCTIONAL GROUPS	TOTALS CURRENT QUARTER	TOTALS 2 YR PERIOD
Rotor, Transmission System/Clutches	121	1083
Powerplant & Related Systems	21	225
Airframe	9	189
Hydraulic System	36	104
Flight Controls	6	83
Util Sys-Htng/Anti-Icing/Fire Prot	-	25
Electrical System	-	16
Aircraft Instruments	-	14
Fuel System	1	7
Other	-	14
TOTALS	194	1760

PERCENTAGE OF TOTAL EIR'S FOR 2 YEARS

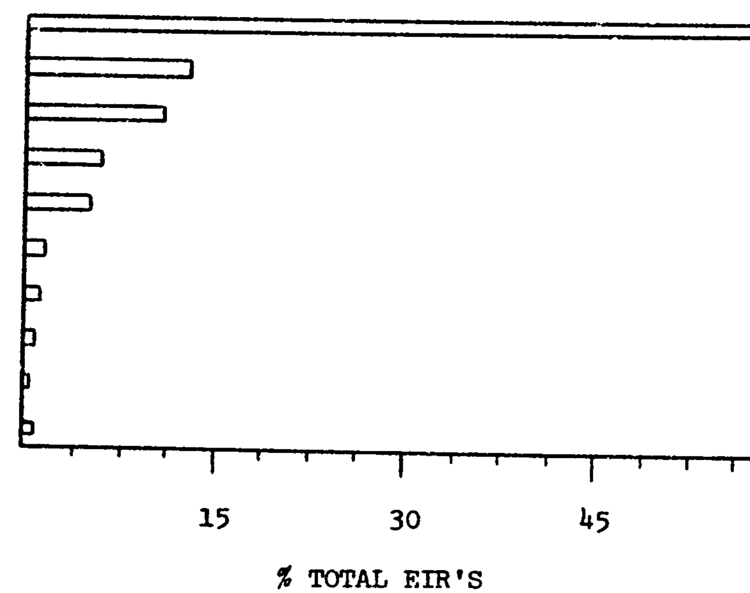


ILLUSTRATION 2

BREAKDOWN BY FUNCTIONAL GROUPS AND PREDOMINANT FAILURE MODES FOR EIR'S ASSIGNED TO CASES ON THE AH-1G FLEET DURING THE TWO YEARS ENDING 31 MAR 1972

FUNCTIONAL GROUPS	THREE PREDOMINANT FAILURE MODES	TOTALS
Rotor, Transmission System/Clutches	Bearing Failure	402
	Loose	75
	Seal Leaking	44
Powerplant and Related Systems	Internal Failure	54
	Bearing Failure	35
	Cracked	14
Airframe	Cracked	30
	Broken	16
	Corroded	15
Hydraulic System	Leaking	42
	Internal Failure	23
	Worn Excessively	4
Flight Controls	Chafed	13
	Unable to Adjust	9
	Bearing Failure	7

EIR'S BY FUNCTIONAL GROUP AND FAILURE MODES FOR TWO YEAR PERIOD

FAILURE MODES AS % OF FUNCTIONAL GROUP

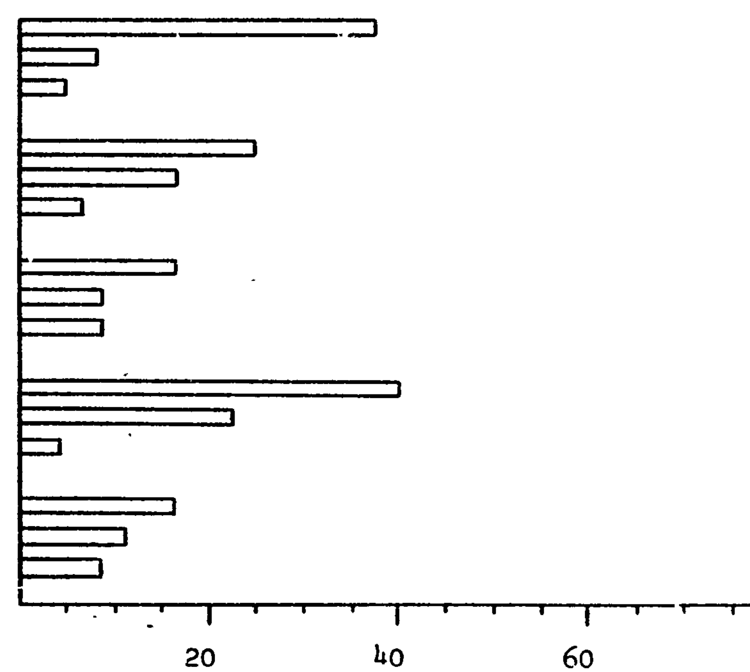


ILLUSTRATION 2 (CONTINUED)

BREAKDOWN BY FUNCTIONAL GROUPS AND PREDOMINANT FAILURE MODES FOR EIR'S ASSIGNED TO CASES ON THE AH-1G FLEET DURING THE TWO YEARS ENDING 31 MAR 1972

FUNCTIONAL GROUPS	THREE PREDOMINANT FAILURE MODES	TOTALS
Utility Systems-Heating/ Anti-Icing/Fire Protection	Cracked	9
	Broken	6
	Internal Failure	3
Electrical System	Internal Failure	8
	Inoperative	4
	Shorted	1
Aircraft Instrument	Internal Failure	6
	Inoperative	2
	Fluctuates	1
Fuel System	Internal Failure	3
	Leaks Fuel	1
	Leaking	1
Other	Broken	10
	Crimped	1
	Improper Fit	1
		823

EIR'S BY FUNCTIONAL GROUP AND FAILURE MODES FOR TWO YEAR PERIOD

FAILURE MODES AS % OF FUNCTIONAL GROUP

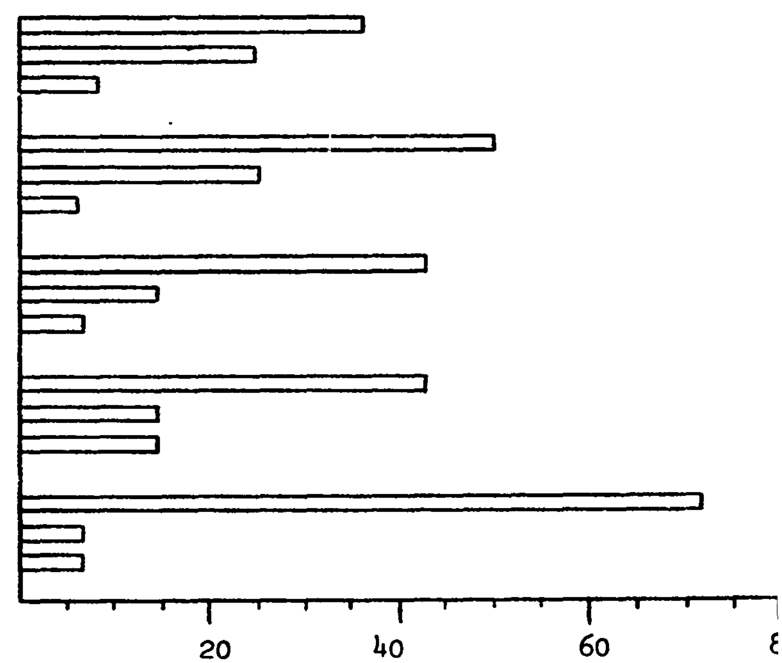


TABLE 2

CHANGE IN EIR SUBMITTAL RATE

Functional Group	% Change	
	Current Quarter	Two-Year Period
Rotor, Transmission System, Clutches	+20	+ 6
Powerplants & Related Systems	+144	+ 43
Airframe	-233	- 66
Hydraulic System	-414	-200
Flight Controls	- 33	- 24

NOTE: The rate of change for the current quarter will be a more substantial increase/decrease than for the two-year period. This reflects a characteristic of "Small Sample" behavior and should not be interpreted as an indication of a sudden spurt or decline in EIR submittals.

The remaining section of this chapter presents an analysis of EIR's by particular component.

COMPONENT ANALYSIS

Table 3 shows the ranking of the five highest components where the greatest number of EIR's were submitted for the quarter.

TABLE 3

"HIGH FIVE" EIR'S

Greatest Number of EIR's For Quarter

COMPONENTS	NO. EIR'S	% TOTAL
Servocylinder Assembly	31	16
Swashplate & Support Assembly	21	11
Engine, Turbine	20	10
Hub, Main Rotor	14	7
Gear Box 42^0	10	5

This is indicative of the degree of trouble these defective units are causing in the field. Also, these components may be taxing the supply pipeline beyond the original spares forecast for support requirements.

As for individual components within the functional groups, Table 4 shows the top 17 components reported failing in EIR cases assigned during the two-year period under observation. These items represent 44.9% of the 1760 EIR's submitted and analyzed. The number of EIR's assigned to a particular part numbered component is presented on a quarterly basis for the purpose of establishing any trends or significant changes. The failure code most often reported against the individual component is also given.

TABLE 4

AH-1G COMPONENT RANKING BY NUMBER OF EIR'S ASSIGNED TO CASES
DURING THE TWO YEARS ENDING 31 MAR 72

PART NUMBER	DESCRIPTION	1970 AMJ	1970 JAS	1970 OND	1971 JFM	1971 AMJ	1971 JAS	1971 OND	1972 JFM	EIR TOTAL	PREDOMINAN MODE
5400111015	Hub, Main Rotor	15	18	18	19	15	32	47	14	178	Bearing Fai
100006010	Engine, Turbine	1	0	0	21	24	38	26	20	130	Internal Fa
2090104001	Swashplate/Support	16	11	9	8	2	25	23	21	115	Bearing Fai
54001115315	Extension Assembly	4	1	2	3	18	17	13	8	66	Loose
20404000337	Gear/Box Assy 42°	6	11	4	1	5	11	7	10	55	Leaking
2040118013	Hub Assy, Tail/Rotor	5	6	6	4	6	11	0	0	38	Bearing Fai
2090104013	Scissors/Sleeve	6	4	1	0	2	3	7	3	26	Lack Lube/B Failure
2090403661	Mast Assy	2	5	1	0	5	5	7	0	25	Chafed
20401170217	Blade, Tail Rotor	4	2	0	0	1	8	2	5	22	Poor Bondin
5400110015	Blade, Main Rotor	13	4	1	2	1	0	1	0	22	Delaminatio
2040400161	Transmission	2	1	6	1	2	1	3	3	19	Metal on Pl
2040604483	Turbine Blower	8	4	3	1	2	0	0	0	18	Bearing Fai
2040117285	Grip Assy, Tail Rotor	8	1	0	2	0	7	0	0	18	Defective Material
20901040111	Scissors/Sleeve	0	0	0	1	1	0	6	10	18	Bearing Fai
5400114871	Extension Assembly	0	0	1	3	1	5	5	1	16	Worn Excess
2040403633	Quill, Main Input	2	5	1	0	2	1	1	0	12	Leaking
PVB 0442	Pump, Axial	2	2	0	3	1	0	1	1	10	Leaking
	TOTAL	94	75	53	69	88	164	149	96	788	

The purpose of Illustrations 3, 4, and 5 is to show a comparison of the EIR data presented in Table 4 with removal rate data as furnished by DA Form 2410 for selected part numbered components. These illustrations are dual ordinate graphs; the first ordinate representing the number of EIR's assigned to cases and the second representing the number of component removals per operating hour. These comparisons are presented for a six quarter, rather than eight quarter, period because of the time lag in 2410 data being processed. The EIR trend is given by the solid line while the broken line illustrates the removal rate.

If a direct correlation appears to exist between EIR submittals and component removal rates such that when one increases the other correspondingly increases, the apparent explanation is that of "stepped-up" maintenance. Stepped-up maintenance is the result of decreased aircraft usage which will allow more time for field personnel to uncover and document problems. The inverse of the situation could, of course, also take place. The purpose of Illustration 6 is to investigate the possibility of any correlation between operational usage and EIR submittals. The broken line illustrates the trend in flight hours for the fleet in given quarterly time periods and the two solid lines portray the total number of EIR's assigned to the seventeen most-reported components presented in Table 4.

ILLUSTRATION 3

EIR - REMOVAL RATE COMPARISON

MAIN ROTOR HUB

P/N 5400111015

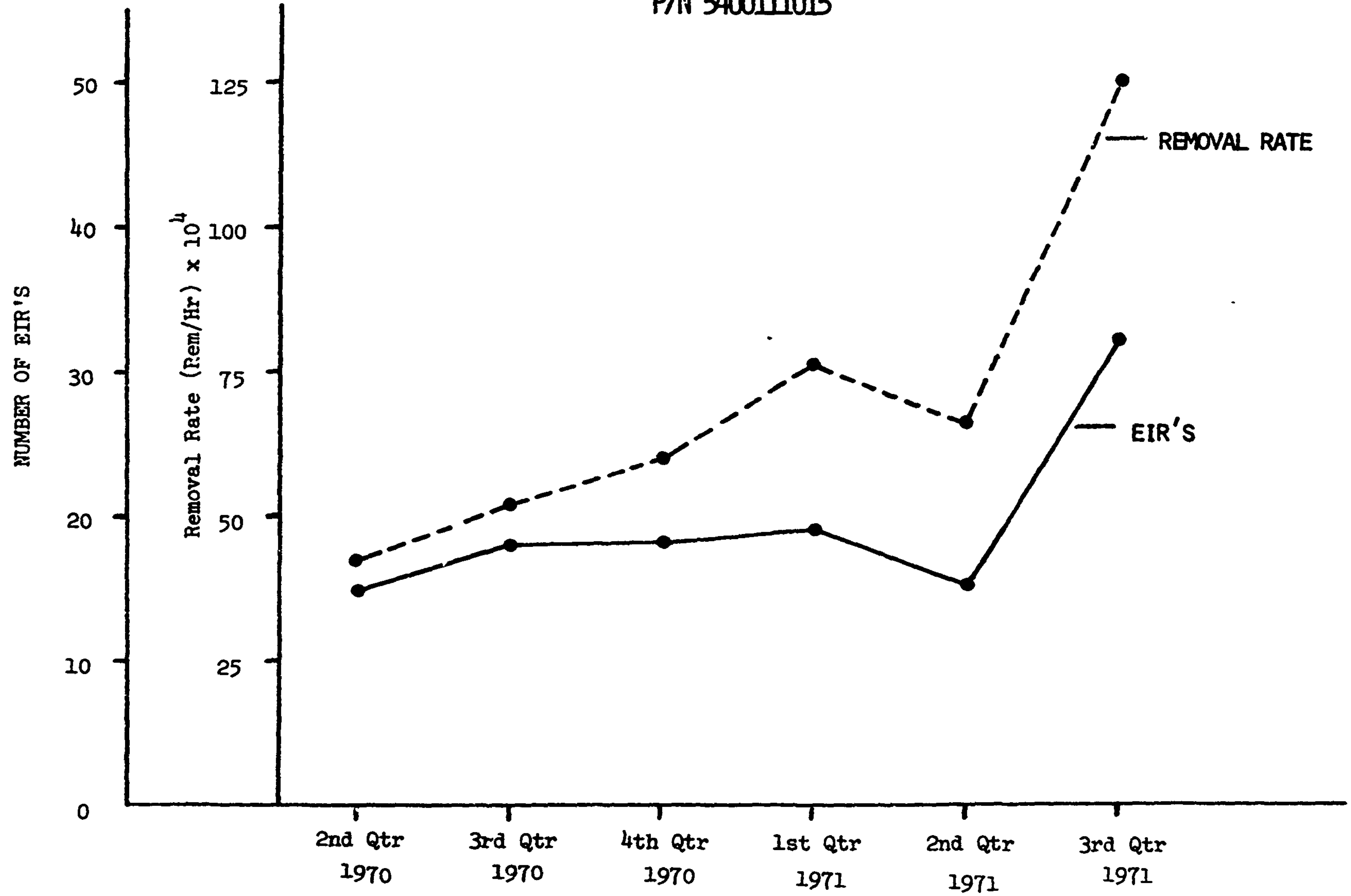


ILLUSTRATION 4

EIR - REMOVAL RATE COMPARISON

SWASHPLATE AND SUPPORT

P/N 2090104001

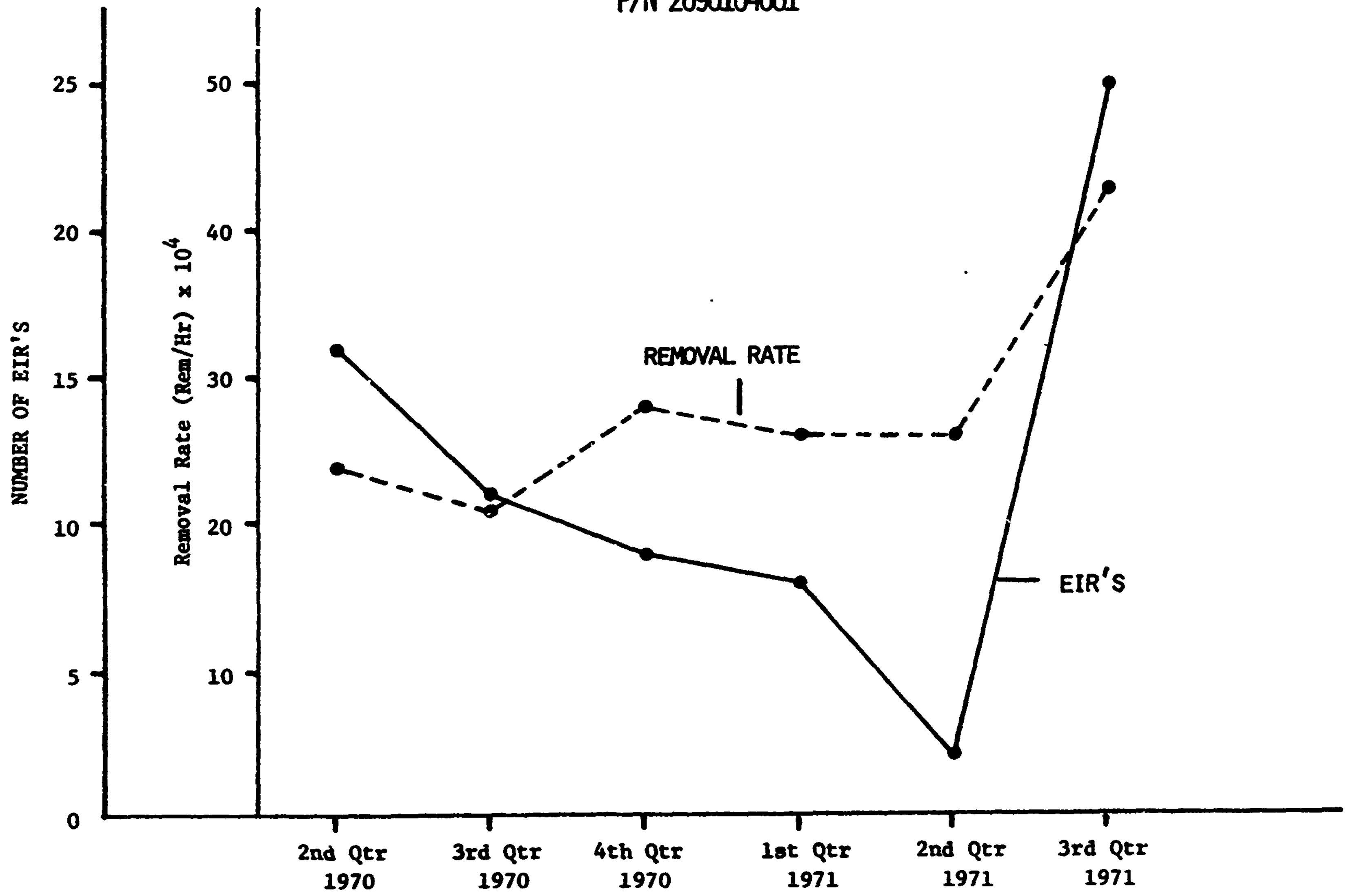


ILLUSTRATION 5

EIR - REMOVAL RATE COMPARISON

TAIL ROTOR BLADE

P/N 20401170217

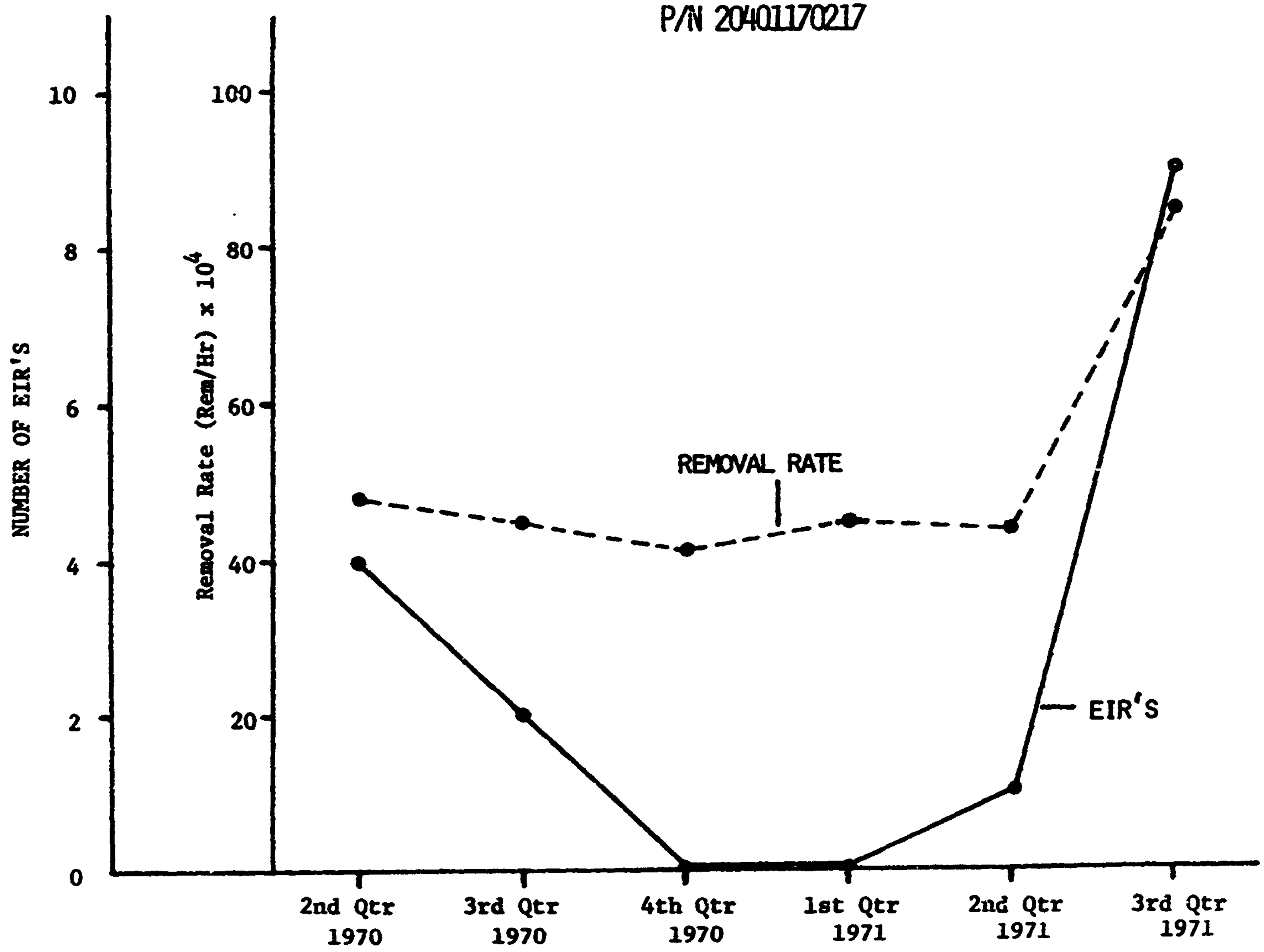
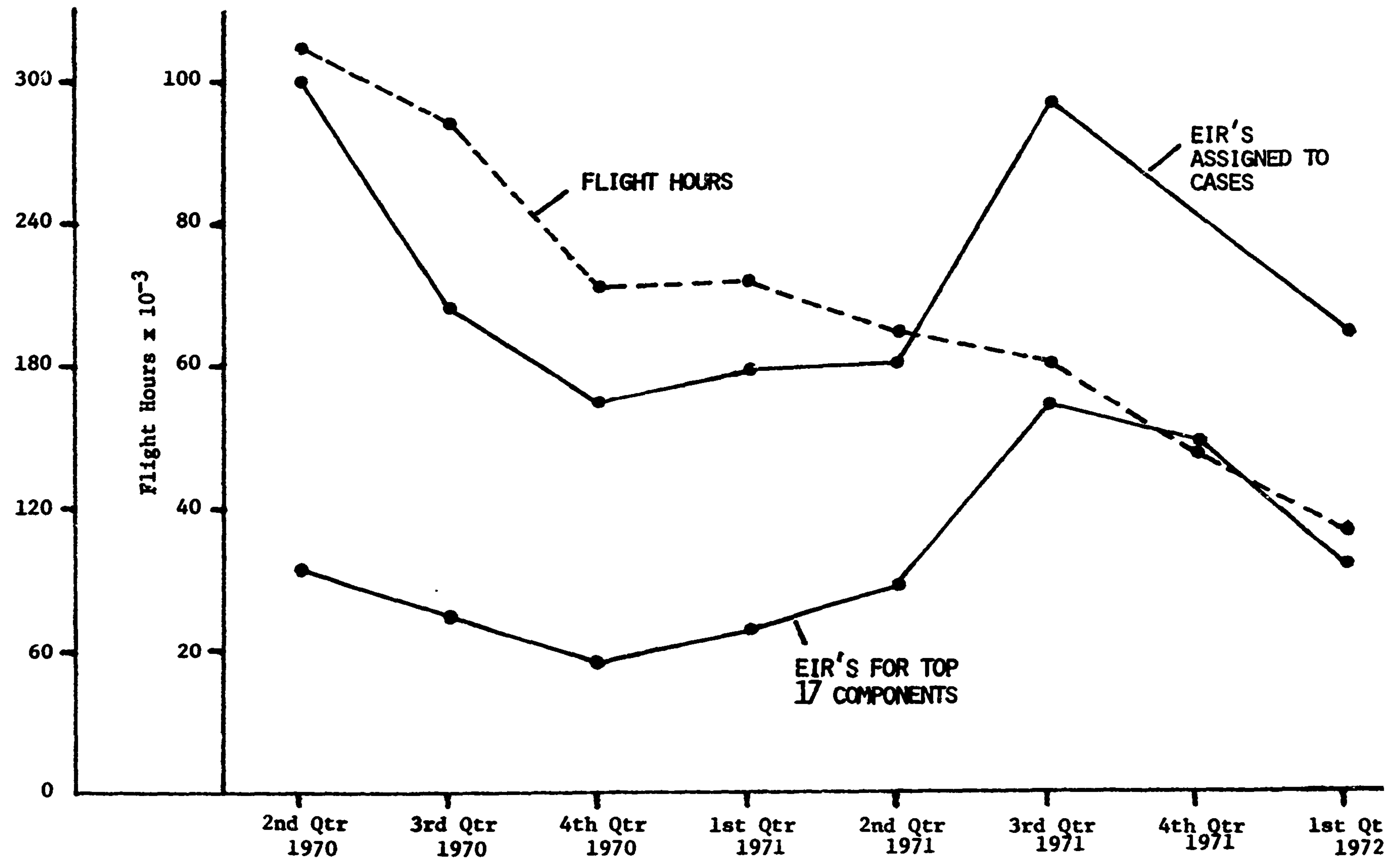


ILLUSTRATION 6

EIR - FLIGHT HOUR COMPARISON



SIGNIFICANT OBSERVATIONS

The previous discussion and analysis of various problem areas provides for the following significant observations:

1. The dynamic components of the Rotor, Transmission System/ Clutches functional group have the greatest quantity of EIR's submitted from field failure experience.

2. Within this same system, the main rotor hub, the 42^{o} gear box, and the swashplate and support assembly are the most troublesome components.

3. The turbine engine continues to exhibit a high removal rate due to "internal failure," but a proper engineering assessment into the nature of these problems cannot be made without a teardown analysis or disassembly inspection of these failed engines.

4. The dominant failure mode of "bearing failure" in the Rotor, Transmission System/Clutches functional group reflects a weakness in the design and application of these bearings or inadequate provision for lubrication. ECP 564, for Elastomeric Flapping Axis Bearings on the AH-1G and UH-1C/M Main Rotor Hub, has been approved and hopefully, these improved bearings will alleviate some of these "bearing failure" problems.

5. The present automated system used for assigning EIR's to their applicable functional group involves matching the component part number of the EIR case number with the part number lists from the -34P technical manual which are on an ADP tape. Only those EIR's which match the tape

are available for analysis; thus limiting the possibilities of a thorough analysis of all reported failures on a specific case problem. This occurs when the -34P tape is not up to date and/or when human errors are made in assigning and transcribing case numbers to the EIR. The Directorate for Product Assurance, Systems Performance Assessment Division, Assessment Methodology Branch (AMSAV-LSA) is investigating the possibilities of developing an automated system for providing a functional breakdown of components for an aircraft system which will not require the -34P manual listings for matching the part numbers used in EIR case numbers.

6. Field activities are keeping a close watch on the EIR program and they are vitally interested in receiving a quick and technically adequate response to their EIR submittals. Therefore, all elements of the Command that are responsible for supporting the EIR effort should aggressively pursue the prime objective of seeking feasible solutions to problems and expediting replies back to the initiator of the report.

7. Illustration 6 does not show any apparent correlation between fleet flying hours and EIR submittals. It does, however, indicate that, on a proportionate basis, the top seventeen failed components presented in Table 4 are highly representative of the total.

RECOMMENDATIONS

Based upon the significant observations previously outlined, it is recommended that:

1. The function of maintaining the EIR control system is being done by AMSAV-LSA and the value of the output of this system is, however, only as good as the input. Therefore, all offices involved with EIR's must make a resolute effort to process all EIR transactions through this office.

2. All action offices should strive to assign EIRs to case numbers accurately and provide answers to EIR's in an expeditious manner.

3. All replies to the field concerning the results of any investigation of emergency or urgent category EIRs should be carefully prepared to insure confidence in the reporting system. This will help minimize those instances where repetitive occurrences will not be arbitrarily upgraded and submitted with hopes to speed up an investigation or obtain unwarranted priorities for routine problems.

EIR EXHIBITS

EIR EXHIBIT ACCOUNTING

INTRODUCTION

Investigation and analysis of Equipment Improvement Recommendations (EIRs) is enhanced by having the defective or failed items available for direct observation and analysis. The exhibits permit the affected National Maintenance Point (NMP) to accomplish analytical teardown that would frequently reveal defects, or failures, which are not normally ascertained during diagnosis and removal of a major item at lower levels of maintenance.

An EIR exhibit can be a fastener, detail part, assembly or component that is selected as a prime example of the deficient condition to support an Equipment Improvement Recommendation and is submitted with a copy of the DA Form 2407 to the NMP.

Although all EIR exhibits must support an EIR, all EIR's do not require an exhibit.

An investigation may be carried to greater depth by having the item or exhibit for analysis. This is usually a disassembly inspection to visually, or by laboratory technique, determine what caused the failure. In more difficult studies, a tear-down analysis can be developed and funded to examine all areas of the item for discrepancies in materials, assembly procedures, incorrect parts or other suspected causes. This chapter will examine the need for a system to account for the exhibits and funding to the agencies or contractors responsible for this work.

SIGNIFICANT OBSERVATIONS

As the result of limited contacts with various organizations within this Command and satellite activities, it appears that an EIR exhibit accounting system is almost non-existent. Apparently, the job of property disposition is achieved without a definite method or process for tracking of exhibits, and the part number and Federal Stock Number seem to be the main criteria used to account for this property.

RECOMMENDATIONS

Due to the lack of a coordinated system of EIR exhibit accountability, it is recommended that:

a. The Directorate for Product Assurance coordinate with responsible elements of this Command and review existing procedures for processing and exhibit disposition and develop a feasible method for systematic exhibit accounting.

b. AVSCOM Regulation 735-2 be revised to incorporate a workable exhibit accounting procedure with the necessary responsibilities and flow diagrams to effect a coordinated system between AVSCOM, the depots, and respective contractors performing exhibit handling and analysis.

FIELD SERVICE REPORTS

FIELD SERVICE REPORTS

Prime aircraft manufacturers and the Army have their own technical service representatives stationed in countries where the equipment is in operation to provide training related to the aircraft and help to resolve maintenance problems. These people who work for the Army are the Department of the Army Civilian Technical Representatives referred to as DAC-Reps.

Whether it is service done on a contract basis by the manufacturer or by the DAC-Rep, the results of their work with the user and the fielded equipment must be recorded and sent to a central place for collection. These reports are being forwarded from all over the globe to the AVSCOM Directorate for Maintenance. These reports are then automated and analyzed by specialists for each aircraft fleet. The information is used to initiate improvements with equipment, manuals, tools, test equipment, training and logistics of replacement parts and accessories.

These reports are prepared from first-hand assistance given to the user for the original problem and the methods used for on-site correction or repairs. While these reports highlight existing failures and show where new trends are developing, they can be used to analyze corrective measures and develop effective product improvement changes.

Early receipt of this data will also permit a coordinated analysis of those failure trends being presently reported through the Equipment

Improvement Recommendations (EIR) data bank. From this, a greater concentration of failure data from widely varying service conditions will be available to permit significant analysis in the Special Studies Chapter.

It is intended that this data will provide the capability to analyze field service reports and EIRs to determine if the user is experiencing problems with new material. These can be compared with the Unserviceable Material Reports (UMR) which indicate when new items are discovered to be discrepant and are rejected prior to storage at the depots or issue to the field.

The Directorate for Maintenance started to automate their Deficiency/Information Reports, SAV-L-A Forms 518, in the latter part of 1971 and have made provisions to cross-reference the reports to the control numbers given for EIR reports. The first substantial collection of this data was analyzed for the periods 15 February through 15 March 1972 and 15 March through 15 April 1972 for all assigned aircraft fleets. The following is a list of those field service reports related to the AH-1G fleet:

AH-1G   S/N 67-15789   ACFT TIME 4:40 HRS

Main Drive Shaft Misalignment, P/N 205-040-004-3. Corrected And Returned To Service. No EIR Submitted.

AH-1G   S/N 70-15981   ACFT TIME 11:30 HRS

Identification Plate Not Installed Correctly, P/N 209-075-222-25. Reinstalled Correctly And Special Report Submitted On Stability Control Augmentation System (SCAS) For This Aircraft.

AH-1G   S/N 67-15791   ACFT TIME 943:00 HRS

Bellcrank P/N 209-001-051-1 Was Worn Off Locally Due To Chafing Action Of Connecting Link Clevis P/N 209-001-063-13. Condition Was Corrected. EIR With Photographs Submitted To AVSCOM.

These reports have not been correlated to existing data in the EIR information bank for a trend, but previous records of these items reveals no significant problem history. As new data becomes available, these areas will be reviewed for any specific actions or recommendations to be included in the Management Summary Report.

MAJOR

ITEMS

MAJOR ITEMS

Major Items include all finite life items, time change items, and items selected because of their high cost or need for intensive management. The data utilized was submitted via the TAERS/TAMMS DA Form 2410. The collection of data utilized in this analysis covers the time period from January 1964 to December 1971. For a more detailed study, it is recommended that RAMMIT Reports, Reportable Items Action Data Sorts (RIADS) and Aircraft Component Time Since Installation, Overhaul, or New (ACTION), be investigated for this fleet.

The objective of this section is to present cost indicators and maintenance characteristics on presently configured major items for the given fleet of aircraft, respectively. All presently configured major items for this fleet have been listed in the tables regardless of the availability of data. However, the RAMMIT system has information on previous component configurations which may be acquired upon request. Those cost indicators depicted within the first two tables of this section are based on both new item procurement cost and estimates of average overhaul/repair cost at depot level activities. All statistics gathered from 2410 records pertaining to "removal" on major items were used in determining the cost indicators regardless of the reason for removal. Also, average installation manhour cost per operating hour on each major item was calculated to determine their relative effect on overall replacement cost.

The cost derivations in this section are based on both current new item acquisition cost and estimates of current overhaul cost. It is emphasized that the several cost comparisons made between two types of cost factors should not be construed to represent total system cost. Regardless of the existing Army policy of procurement, there are certain incurred costs which are not included in the above mentioned cost comparisons. Such cost related considerations as shipping, storage, depreciation, inventory carrying cost, capacity cost, and investment cost have not been viewed in this section. However, such cost factors must be comtemplated in conjunction with future Army procurement policies. This philosophy should be remembered when viewing the first two tables which deal exclusively with cost information.

The remaining three tables display and rank each of the major items according to average installed operating hours, average manhours to install and installation manhours per installed operating hours. Each of these tables provide the nomenclature, part numbers and federal stock numbers for all presently configured major items on the fleet. Brief descriptions and any significant observations parallel the following tables.

TABLE 1

COMPARATIVE ANALYSIS OF MAJOR ITEM COST INDICATORS

The cost indicators presented in the following table provide a means for comparing the Army's policies in existence; replacement with a new major item or replacement with an overhauled item. The cost differences are presented in columns 1 and 2 for each of the major items analyzed in this chapter. It is emphasized that these cost statistics are only approximations of actual cost but furnish a means for taking relative measurements on the Army's maintenance policies.

In some cases a major item appears two or more times on an aircraft system (see column 3). These additional items have an effect on the overall cost picture per operating hour. For example, there are two main rotor blades on an aircraft which must be replaced on an average of operating hours. The true cost of replacing these blades would be equal to twice the item acquisition cost or overhaul cost. The result is that a new cost indicator must be derived for both acquisition and overhaul cost.

The "new item cost indicator per operating hour" (Col 4) and the "overhaul/repair cost indicator per operating hour" (Col 5) represent the upper and lower bounds of the actual cost to "purchase" these major items. The "new item cost indicator" coincides with an Army policy of replacing all major items with new items. Likewise, the overhaul cost indicator coincides with a policy of replacement with overhauled items. A summation of each of these parameters gives the range of average cost for replacing these major items on a flight hour basis. As depicted in table 1 an Army policy of replacing major items with newly purchased items will cost significantly more per operating flight hour in contrast to a policy of replacement with overhauled items. It is intuitively obvious that the choice of policy (or mixture of policies) will have a significant effect on the potential cost per operating flight hour for the procurement of major items.

The last column displays the installation manhour cost per operating hour for each of the major items. This parameter remains constant regardless of the policy of replacement. The summation of these values gives the relative manhour cost per operating hour to install those major items and must be considered in conjunction with the previously mentioned parameters as an influential cost factor. Comparison of the manhour cost indicator with that of the item cost indicators reveals the impact which installation manhours has on the cost of replacing a major item.

The cost parameters presented in this table were derived from two basic estimates: procurement cost estimates (new purchase cost or overhaul cost), and average installed operating hours which is an estimate of the usage rate for major items. Thus, any measurements made utilizing these parameters will be based on actual usage of the major items and not on aniticpated demand for these items. Logically, this is a more reasonable approach in determining future materiel requirements and more significantly in determining future monetary needs through budgetary proposals using different Army procurement policies. The usage rate (historical data) may be utilized in conjunction with existing procurement methods to determine future requirements. It is anticipated that this additonal information concerning major items would aid in projecting true requirements and enhance supply personnel with their task of meeting demands at lowest possible cost. In retrospect, procurement problems should be resolved through decisions based on all available information.

By increasing the average installed operating hour (reducing frequency) value for each major item, an overall cost reduction may be realized in any replacement policy (program). Improved quality of those major items exhibiting low average installed operating hours with corresponding high unit cost will have a substantial effect on the cost of maintenance. Maintainability may also be improved through better design features which will reduce installation manhour cost per operating flight hour. For those major items which exhibit a relatively high installation manhour cost in relation to procurement cost, improvements in design, maintenance procedures or equipment will proportionally reduce overall cost. Lastly, table 1 indicates that an intensified overhaul/repair program has the greatest potential of reducing major item cost for the fleet.

TABLE 1

MAJOR ITEMS RANKED BY NEW ITEM COST INDICATORS PER OPERATING HOURS FOR
ALL REMOVALS ON THE AH-1G FLEET FOR THE PERIOD COVERING JAN 01, 1964 THROUGH DEC 31, 1971

NOMENCLATURE	APPROXIMATE NEW ITEM COST	APPROXIMATE OVERHAUL REPAIR COST	NO. OF ITEMS PER AIRCRAFT	NEW ITEM COST INDICATOR PER OPERATING HOUR	OVERHAUL/ REPAIR COST INDICATOR PER OPERATING HOUR	INSTALLATION MANHOUR COST INDICATOR PER OPERATING HOUR
Engine, Turbine	$68,510.00	$14,871.39	1	$278.95	$60.55	$1.79
Hub, Main Rotor	10,643.00	3,051.02	1	54.58	15.65	.57
Blade Assy M/P	3,408.00	580.00	2	32.84	5.58	.29
Transmission Assy	11,620.00	2,488.00	1	21.05	4.51	.56
Servo Cylinder W/Mount	1,661.00	279.41	1	6.16	1.04	.18
Driveshaft, Engine Trans	1,464.00	270.13	1	6.05	1.12	.16
Quill Assy, Main Input	1,786.00	334.19	1	4.85	.91	.21
Gear Box 90°	1,538.00	416.77	1	3.70	1.00	.20
Hub Assy, T/R	559.00	559.00	1	3.59	3.59	.33
Mast Assy	1,473.00	434.97	1	3.40	1.02	.31
Blade Assy, T/R	286.00	286.00	2	3.28	3.28	.23
Scissors & Sleeve Assy	1,420.00	739.00	1	3.21	1.67	.27
Swashplate & Support Assy	1,261.00	526.00	1	3.10	1.29	.35
Gear Box 42°	1,144.00	320.87	1	2.56	.72	.12
Hanger Assy, T/R Shaft	205.00	48.00	4	2.28	.52	.08
Starter Generator Assy	443.00	137.70	1	.97	.30	.17
Engine Mount Trunnion	9.27	9.27	1	.07	.07	.33
				$430.64.HR*	$102.82/HR*	$6.15/HR**

*Based only on approximate new item procurement cost and approximate depot level overhaul/repair cost.
**Based only on manhours to install at $16.50 per hour.

TABLE 2

POTENTIAL COST SAVINGS

The cost indicators derived in the previous table place quantitative values on expected cost given a particular maintenance policy. Although these cost indicators are estimates, they, nevertheless, furnish maximum and minimum values for an array of possible costs. By taking these extreme values and extrapolating requirements under future flight hour programs, a relative measurement of potential cost savings may be obtained. This is accomplished by comparing the overall cost between a policy of replacement with new major items or with overhauled major items. Note that these potential cost savings are based on usage rates rather than demand rates.

Table 2 displays the cost savings which might be realized under 40 flight hour, 50 flight hour, and 60 flight hour programs per month, respectively. Two assumptions are made under these computations. First, the size of the fleet was held constant at a given number of aircraft. Obviously, this value will change over time but the percentage of savings should remain constant. Lastly, the new item cost indicator and overhaul cost indicator, as derived in the previous table, were used in the computations. Both of these indicators are based on a particular removal rate for aircraft in the entire fleet. Thus, the results in table 2 are based on a constant removal rate. If this removal rate changes during any future time frame, the potential cost savings will change.

By summing each of the columns under the given flight hour programs, potential savings are obtained at the fleet level for all major items as a whole. These values represent possible savings for only <u>one</u> month. On a yearly basis these values would be twelve times greater and certainly provide evidence that this area is tremendously vulnerable to cost reduction. Cost reduction studies should be focused on those specific major items which exhibit the greatest potential savings. The result is that the overall fleet cost for major items will be reduced significantly.

TABLE 2

POTENTIAL COST SAVINGS PER MONTH FOR A FLEET OF 600
AH-1G AIRCRAFT UNDER VARIOUS FLIGHT HOUR PROGRAMS

NOMENCLATURE	40 FLIGHT HOURS PER MONTH PER AIRCRAFT (in thousands)			50 FLIGHT HOURS PER MONTH PER AIRCRAFT (in thousands)			60 FLIGHT HOURS PER MONTH PER AIRCRAFT (in thousands)		
	NEW ITEM COST	O/H ITEM COST	POTENT. SAVINGS	NEW ITEM COST	O/H ITEM COST	POTENT. SAVINGS	NEW ITEM COST	O/H ITEM COST	POTENT. SAVINGS
Engine, Turbine	$6694.8	$1453.2	$5241.6*	$8368.5	$1816.5	$6552.0	$10042.2	$2179.8	$7862.4
Hub, Main Rotor	1309.9	375.6	934.3	1637.4	469.5	1167.9	1964.9	563.4	1401.5
Blade Assy, Main Rotor	788.2	133.9	654.3	985.2	167.4	817.8	1182.2	200.9	981.3
XMSN Assy, Universal	505.2	108.2	397.0	631.5	135.3	496.2	757.8	162.4	595.4
Servo Cylinder Assy W/Mount	147.8	25.0	122.8	184.8	31.2	153.6	221.8	37.4	184.4
Driveshaft, Engine to XMSN	145.2	26.9	118.3	181.5	33.6	147.9	217.8	40.3	177.5
Quill Assy, Main Input	116.4	21.8	94.6	145.5	27.3	118.2	174.6	32.8	141.8
Gear Box, 90°	88.8	24.0	64.8	111.0	30.0	81.0	133.2	36.0	97.2
Hub Assy, Tail Rotor	86.2	86.2	00.0	107.7	107.7	00.0	129.2	129.2	00.0
Mast Assy	81.6	24.5	57.1	102.0	30.6	71.4	122.4	36.7	85.7
Blade Assy, Tail Rotor	78.7	78.7	00.0	98.4	98.4	00.0	118.1	118.1	00.0
Scissors & Sleeve Assy	77.0	40.1	36.9	96.3	50.1	46.2	115.6	60.1	55.5
Swashplate & Support Assy	74.4	31.0	43.4	93.0	38.7	54.3	111.6	46.4	65.2
Gear Box, 42°	61.4	17.3	44.1	76.8	21.6	55.2	92.2	25.9	66.3
Hanger Assy, T/R Shaft	54.7	12.5	42.2	68.4	15.6	52.8	82.1	18.7	63.4
Starter Generator Assy	23.3	7.2	16.1	29.4	9.0	20.4	34.9	10.8	24.1
Engine Mount Trunnion	1.7	1.7	00.0	2.1	2.1	00.0	2.5	2.5	00.0
TOTAL			$7867.5			$9834.9			$11801.7

*Derived as follows: New Item Cost = (600 aircraft) X (40 FH/M/AC) X $278.95/hr. = $6694.8 (in thousands)
Overhaul Item Cost = (600 aircraft) X (40 FH/M/AC) X $60.55/hr. = 1453.2 (in thousands)
POTENTIAL SAVINGS = $5241.6 (in thousands)

SIGNIFICANT OBSERVATIONS

1. The potential cost savings for each of the AH-1G major items represents only a relative means for measurement. The values should not be construed to represent actual cost savings.

2. The values under new item cost and overhaul item cost should be interpreted as maximum and minimum values of a range of possible cost savings.

3. Summing the potential cost savings for each of the 17 major items will give an indication as to possible savings on replacement of major items at the fleet level. Under an Army policy of replacement through overhauled items, the following are potential savings per month:

   @ a 40 flight hour program - $ 78,675,000.00*

   @ a 50 flight hour program - $ 98,349,000.00*

   @ a 60 flight hour program - $ 118,017,000.00*

4. The above potential savings may be more quickly realized by establishing cost reduction procedures and policy for overhauling major items: especially on the turbine engines, main rotor hubs and main rotor blades which could provide a large savings.

*These potential cost savings do not include shipping cost, depreciation cost, inventory carrying cost, etc., and must be a factor of consideration when developing future Army replacement policies.

TABLES 3 & 4 & 5

TABLE 3 - Average Installed Operating Hour

The average installed operating hour is a measure of how long a particular major item will operate without removal for any reason on new and overhauled major items. The major items are ranked for this parameter in ascending order. Using average installed operating hour as a reliability index, the major items with low operating hour values are prime candidates for improved reliability emphasis.

TABLE 4 - Average Manhours to Install

This parameter shows the relative time expenditures to install each of the major items. The summation value for each major item is a weighted average of all the statistics found under each FSN. The manhour sample size reveals the weight of each statistic. Again, the parameter is ranked, but in descending order.

TABLE 5 - Installation Manhours Per Installed Operating Hour

Installation manhours per installed operating hour reveals the maintenance manhours needed for every flight hour expended on the fleet. The parameter provides a means for identifying areas where new maintenance policies or procedures might enhance maintainability. The summation values for each of the items is placed in descending order so that special attention might be placed on those major items with high installation manhours per installed operating hour.

TABLE 3

MAJOR ITEMS RANKED BY AVERAGE INSTALLED OPERATING HOURS FOR ALL REMOVALS ON THE AH-1G FLEET FOR PERIOD COVERING JAN 01, 1964 THROUGH DEC 31, 1971

NOMENCLATURE	PART NUMBER	FSN	INSTALLED OPERATING HOUR SAMPLE SIZE	AVERAGE INSTALLED OPERATING HOUR
Hub Assy, T/ R	************SUMMATION	************	5030	134.7
	209-010-701-3	1615-928-6311	3544	104.2
	204-011-801-3	1615-178-8531	1486	207.5
Engine Mount, Trunnion	209-060-113-1	1560-917-1792	40	139.1
Blade Assy, T/R	204-011-702-17	1615-907-0842	6382	174.3
Hub, Main Rotor	540-011-101-5	1615-918-9357	3617	195.0
Blade Assy, M/R	************SUMMATION	************	6038	207.6
	540-011-001-5	1615-847-7461	3722	233.3
	540-011-250-1	1615-178-9680	2316	166.3
Driveshaft, Engine to Transmission	************SUMMATION	************	3291	241.9
	205-040-004-3	1615-068-6635	1538	258.5
	204-040-010-7	1615-863-3819	1753	227.4
Servo Cylinder Assy W/Mount	204-076-005-11	1650-183-5949	980	269.5
Engine Turbine	************SUMMATION	************	3933	276.6
	T53-L-13 1-000-060-3	2840-911-7685	1145	279.2
	T53-L-13A 1-000-060-8	2840-102-3969	2466	289.6
	T53-L-13B 1-000-060-10	2840-134-4803	322	168.1
Hanger Assy, Tr Shaft	204-040-600-9	1615-832-8951	4627	360.4
Quill Assy, Main Input	205-040-263-3	1615-134-3087	84	368.0
Swashplate & Support Assy	209-010-400-1	1615-914-6160	1677	407.1
Gear Box, 90°	204-040-012-13	1615-918-2677	1806	416.0

TABLE 3 (CONTINUED)

MAJOR ITEMS RANKED BY AVERAGE INSTALLED OPERATING HOURS FOR ALL REMOVALS ON THE AH-1G FLEET FOR PERIOD COVERING JAN 01, 1964 THROUGH DEC 31, 1971

NOMENCLATURE	PART NUMBER	FSN	INSTALLED OPERATING HOUR SAMPLE SIZE	AVERAGE INSTALLED OPERATING HOUR
Gear Box, 42°	204-040-003-37	1615-918-2676	1926	446.7
Mast Assy	************SUMMATION	************	1242	451.5
	209-040-366-1	1615-919-4642	790	500.8
	209-040-366-3	1615-179-9165	452	365.4
Starter Generator Assy	204-060-200-1	2925-878-1136	540	461.8
Scissors & Sleeve Assy	************SUMMATION	************	1230	463.3
	209-010-401-1	1615-914-6169	335	545.4
	209-010-401-3	1615-570-9767	676	450.9
	209-010-401-5	1615-442-2512	102	530.8
	209-010-401-11	1615-168-5863	117	240.7
Transmission Assy	************SUMMATION	************	1054	523.1
	204-040-009-65	1615-929-5807	211	570.7
	204-040-016-1	1615-089-6509	704	495.7
	204-040-016-5	1615-183-0834	139	589.7

TABLE 4

MAJOR ITEMS RANKED BY AVERAGE MANHOURS TO INSTALL FOR ALL REMOVALS
ON THE AH-1G FLEET FOR THE PERIOD COVERING JAN 01, 1964 THROUGH DEC 31, 1971

NOMENCLATURE	PART NUMBER	FSN	MANHOUR SAMPLE SIZE	AVERAGE MANHOUR TO INSTALL
Engine, Turbine	************SUMMATION************		2637	27.22
	T53-L-13 1-000-060-3	2840-911-7685	549	25.84
	T53-L-13A 1-000-060-8	2840-102-3969	1413	28.40
	T53-L-13B 1-000-060-10	2840-134-4803	675	25.88
Transmission Assy	************SUMMATION************		687	22.45
	204-040-009-65	1615-929-5807	101	6.45
	204-040-016-1	1615-089-6509	520	25.48
	204-040-016-5	1615-183-0834	66	23.11
Swashplate & Support Assy	209-010-400-1	1615-914-6160	1365	8.63
Mast Assy	************SUMMATION************		1056	8.09
	209-040-366-1	1615-919-4642	505	7.59
	209-040-366-3	1615-179-9165	551	8.54
Hub, Main Rotor	540-011-101-5	1615-918-9357	2936	6.72
Scissors & Sleeve Assy	************SUMMATION************		826	5.74
	209-010-401-1	1615-914-6169	91	6.84
	209-010-401-3	1615-570-9767	482	4.57
	209-010-401-5	1615-442-2512	27	10.48
	209-010-401-11	1615-168-5863	226	7.24
Gear Box, 90°	204-040-012-13	1615-918-2677	1343	4.95
Starter Generator Assy	204-060-200-1	2925-878-1136	292	4.73
Quill Assy, Main Input	205-040-263-3	1615-134-3087	34	4.41

TABLE 4 (CONTINUED)

MAJOR ITEMS RANKED BY AVERAGE MANHOURS TO INSTALL FOR ALL REMOVALS
ON THE AH-1G FLEET FOR THE PERIOD COVERING JAN 01, 1964 THROUGH DEC 31, 1971

NOMENCLATURE	PART NUMBER	FSN	MANHOUR SAMPLE SIZE	AVERAGE MANHOUR TO INSTALL
Blade Assy, M/R	************SUMMATION************		6136	3.71
	540-011-001-5	1615-847-7461	3158	3.81
	540-011-250-1	1615-178-9680	2978	3.61
Gear Box, 42°	204-003-37	1615-918-2676	1588	3.32
Hub Assy, T/R	************SUMMATION************		5080	3.04
	209-010-701-3	1615-928-6311	3446	2.92
	204-011-801-3	1615-178-8531	1634	3.29
Servo Cylinder Assy W/Mount	204-076-005-11	1650-183-5949	1283	2.98
Engine Mount Trunnion	209-060-113-1	1560-917-1792	4	2.75
Blade Assy, T/R	204-011-702-17	1615-907-0842	7032	2.44
Driveshaft, Engine to Trans	************SUMMATION************		2624	2.34
	205-040-004-3	1615-068-6635	1158	2.27
	204-040-010-7	1615-863-3819	1466	2.40
Hanger Assy, T/R Shaft	204-040-600-9	1615-832-8951	4139	1.78

TABLE 5

MAJOR ITEMS RANKED BY INSTALLATION MANHOURS PER INSTALLED OPERATING HOUR FOR ALL REMOVALS ON THE AH-1G FLEET FOR THE PERIOD COVERING JAN 01, 1964 THROUGH DEC 31, 1971

NOMENCLATURE	PART NUMBER	FSN	AVERAGE MANHOURS TO INSTALL	INSTALL M/H PER INSTALL OPERATING HOURS
Engine Turbine	************SUMMATION************		27.22	.0984
	T53-L-13 1-000-050-3	2840-911-7685	25.84	.0925
	T53-L-13A 1-000-060-8	2840-102-3969	28.40	.0981
	T53-L-13B 1-000-060-10	2840-134-4803	25.88	.1540
Transmission Assy	************SUMMATION************		22.45	.0429
	204-040-009-65	1615-929-5807	6.45	.0113
	204-040-016-1	1615-089-6509	25.48	.0514
	204-040-016-5	1615-183-0834	23.11	.0392
Hub, Main Rotor	540-011-101-5	1615-928-6311	6.72	.0345
Hub Assy, T/R	************SUMMATION ************		3.04	.0226
	209-010-701-3	1615-928-6311	2.92	.0280
	204-011-801-3	1615-178-8531	3.29	.0159
Swashplate & Support Assy	209-010-400-1	1615-914-6160	8.63	.0212
Engine Mount Trunnion	209-060-113-1	1560-917-1792	2.75	.0198
Blade Assy, M/R	************SUMMATION************		3.71	.0179
	540-011-001-5	1615-847-7461	3.81	.0163
	540-011-250-1	1615-178-9680	3.61	.0217
Mast Assy	************SUMMATION************		8.09	.0179
	209-040-366-1	1615-919-4642	7.59	.0152
	209-040-366-3	1615-179-9165	8.54	.0234
Blade Assy, T/R	204-011-702-17	1615-907-0842	2.44	.0140

TABLE 5 (CONTINUED)

MAJOR ITEMS RANKED BY INSTALLATION MANHOURS PER INSTALLED OPERATING HOUR FOR ALL REMOVALS ON THE AH-1G FLEET FOR THE PERIOD COVERING JAN 01, 1964 THROUGH DEC 31, 1971

NOMENCLATURE	PART NUMBER	FSN	AVERAGE MANHOURS TO INSTALL	INSTALL M/H PER INSTALL OPERATING HOURS
Scissors & Sleeve Assy	************SUMMATION************		5.74	.0124
	209-010-401-1	1615-914-6169	6.84	.0125
	209-010-401-3	1615-570-9767	4.57	.0101
	209-010-401-5	1615-442-2512	10.48	.0197
	209-010-401-11	1615-168-5863	7.24	.0301
Quill Assy, Main Input	205-040-263-3	1615-134-3087	4.41	.0120
Gear Box, 90°	204-040-012-13	1615-918-2677	4.95	.0119
Servo Cylinder Assy W/Mount	204-076-005-11	1650-183-5949	2.98	.0111
Starter Generator Assy	204-060-200-1	2925-878-1136	4.73	.0102
Driveshaft, Engine to Trans	************SUMMATION************		2.34	.0097
	205-040-004-3	1615-068-6635	2.27	.0088
	204-040-010-7	1615-863-3819	2.40	.0106
Gear Box, 42°	204-040-003-37	1615-918-2676	3.32	.0074
Hanger Assy, T/R Shaft	204-040-600-9	1615-832-8951	1.78	.0049

TABLES 3 & 4 & 5

SIGNIFICANT OBSERVATIONS

1. Based on the sample of 43,497 records, with operating hours totaling 11,826,533.2 the average operating time for major items collectively is 271.9 hours (table 3).

2. Of the 17 major items exhibited, the tail rotor hub assembly is the most frequently removed with average installed operating time of 134.7 hours (table 3).

3. The average manhours to install based on 39,062 records and 218,155.41 manhours is 5.58 manhours (table 4).

4. On the average, manhour cost per installation for all major items collectively is $92.07 (table 4).

5. The installation of a turbine engine consumes the greatest number of manhours of all major items on the AH-1G fleet (table 4).

6. On a per operating hour basis, the turbine engine is using the greatest number of installation manhours (table 5).

7. The data reveals that the turbine engine is experiencing difficulty. The frequency of replacement for this engine is 276.6 operating hours and requires .0984 manhours per installation operating hour (tables 3 & 5).

RECOMMENDATIONS ON AH-1G FLEET

1. The Directorate for Maintenance should review the possibility of establishing a more intensified overhaul program. With better overhaul facilities available, it seems possible that an Army policy of replacement through overhauled major items would reduce operating cost substantially. In this proposed review, it becomes necessary to assure that the overhaul program is in balance by equating the output rate with the utilization rate.

2. The Directorate for Research, Development, and Engineering should establish procedures for improving the design features for installation of major item assemblies. The overall objective would be the investigation of methods for adequately reducing manhour installation cost. For example, since installation manhour cost per operating hour is greatest for the turbine engine, a more adequate design for easier maintainability might reduce overhaul installation manhour cost for the AH-1G fleet.

3. For those major items which possess a high frequency of removal, such as the tail rotor hub, the RAMMIT Coordinator in the Directorate for Product Assurance should identify the predominant failure modes for these items. Once the reasons for failure have been determined, studies should be initiated with the ultimate purpose of cost savings through product improvement.

4. The RAMMIT Coordinator should also determine potential cost savings by innovating means for increasing the maximum allowable operating time (MAOT) between removals without altering flight safety. This will obviously increase cost savings.

5. With the existing ability of identifying predominant failure modes on major items, the RAMMIT Coordinator should determine where additional research, development, test, and engineering (RDT&E) resources might be directed to develop new materiel for improving the reliability and maintainability of major items.

6. Lastly, the Directorate for Materiel Management should advise the RAMMIT Coordinator of the current status of presently configured major items so that information published in this section is as current and accurate as possible.

SIGNIFICANT OBSERVATIONS

1. On a flight hour basis the turbine engine is presently the most expensive major item.

2. The manhour installation cost per operating hour is greatest for the turbine engine component. However, in relation to the procurement or overhaul cost the tail rotor hub assembly carries a significant cost.

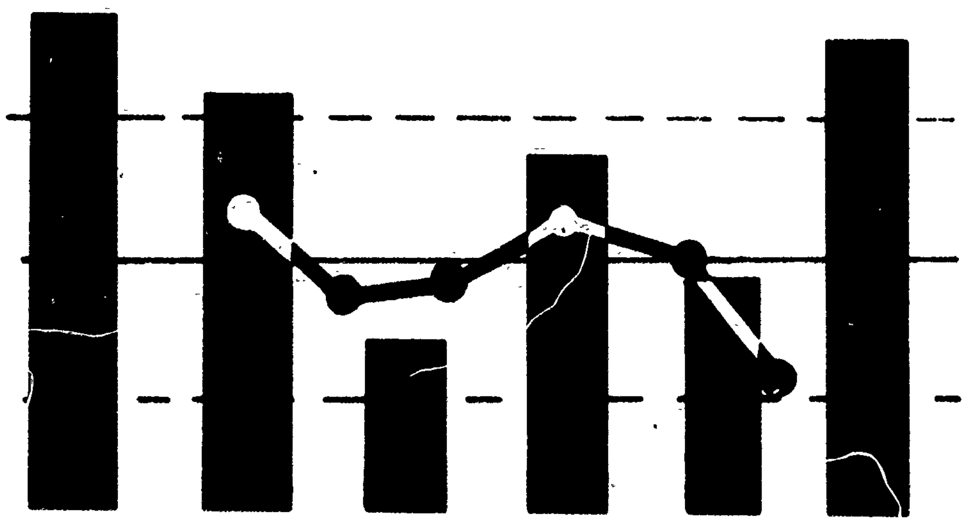
3. From an overall point of view it is costing the government approximately $430.64 per operating hour to support a replacement policy of new major items for the AH-1G fleet. Likewise, a replacement policy of overhaul would reduce the above figure to $102.82 per operating hour.

4. For every hour that an AH-1G aircraft is in operation, it costs the government approximately $6.15 for the installation of major items.

5. Any major items with high values of cost per operating hour would be considered candidates for analysis.

6. In some cases, it becomes more economical to purchase new major items even though they carry higher costs than overhauled major items. This should be considered when there is only a slight difference between the new item cost indicators and overhaul cost indicators. Since overhead and administrative cost are not included in the overhaul cost indicators, they must be taken into consideration when comparing those cost indicators which differ slightly.

MAJOR ITEMS TRENDS



MAJOR ITEMS TRENDS

These charts and graphs are unique from the Major Items and Comparison chapters in that the span of time covers only a two year period, which is divided into calendar quarters, rather than a seven year cumulative total of removal data. The reporting period covered with this data is from October 1, 1969 to September 30, 1971. As further data becomes available, it will be added by successive quarters and the first quarter reported will be automatically dropped to maintain the two year time span.

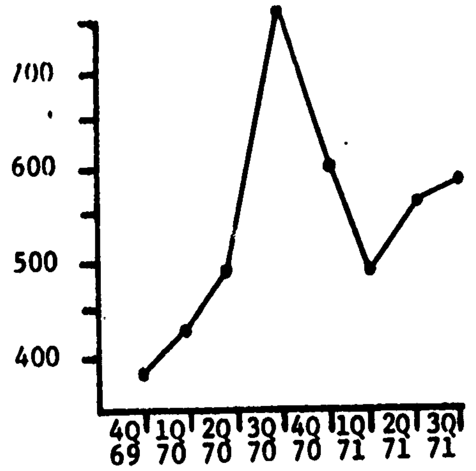
The first set of graphs indicate the MTR (Mean Time To Removal) for each of the items on which data was available. Those quarters where data is not available, the break in the trend line will be marked by an asterisk. The trend lines end where the last data was available in the MITS (Major Items Trend) reports.

The second set of graphs and bar charts represent the dominant, secondary and next significant failure codes together with their respective percentage of failures per calendar quarter. In selecting the failure codes for ranking purposes, the induced failures (503-Sudden Stop, 712-Crash Damage, 713-Battle Damage, and 717-Accident Damage) were screened from the data and eliminated. The numbers at the top of the bar charts indicate the percentage of failures to match the trend line and the numerals inside each bar refer to the failure code listed in the legend at the bottom of the page.

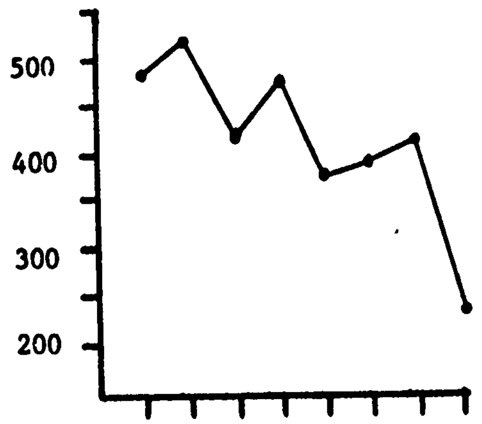
The third set of graphs consist of an overlay of different part numbered components of the same type, such as two different transmissions. One trend line is superimposed over the other and identified by part numbe. This will indicate where a specific item may have been replaced by another configuration, improved or show the relative reliability of one component over another. These trends may also be related to specific maintenance actions performed during differing flight hour profiles, aircraft configurations or types of missions.

OCTOBER 1, 1969 THRU SEPT 30, 1971
MEAN TIME TO REMOVAL (MTTR)

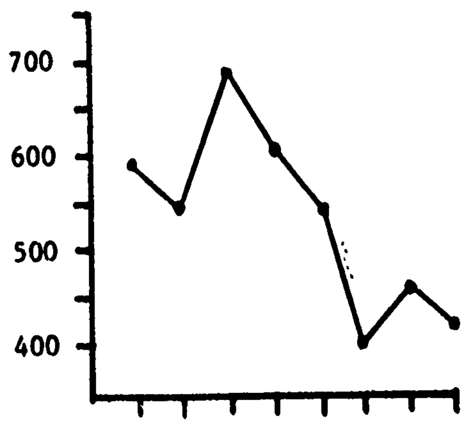
STARTER GENERATOR
PN 2040602001



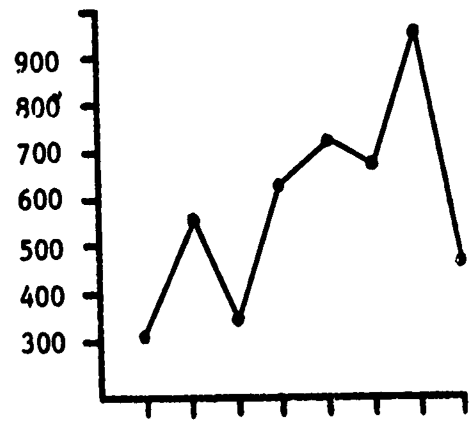
SWASHPLATE & SUPPORT
PN 2090104001



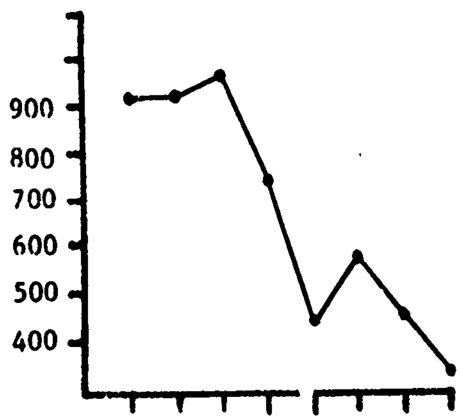
TRANSMISSION
PN 2040400161



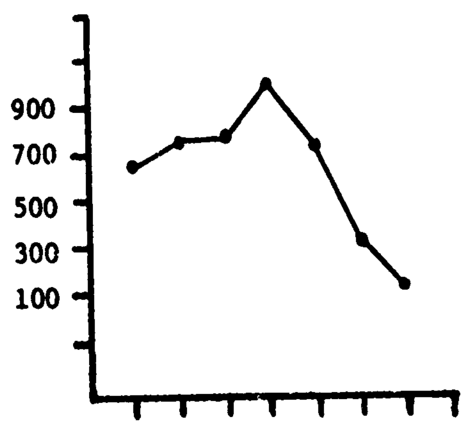
TRANSMISSION
PN 2040400165



TRANSMISSION
PN 20404000965



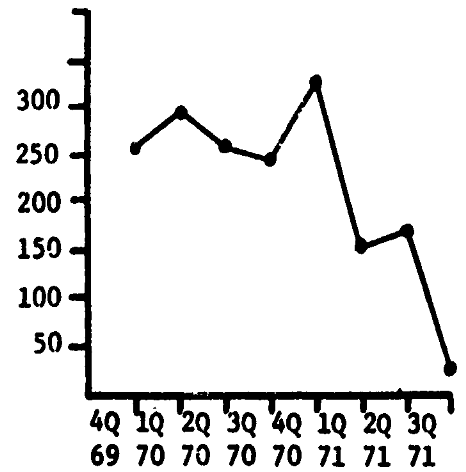
SCISSORS & SLEEVE
PN 2090104011



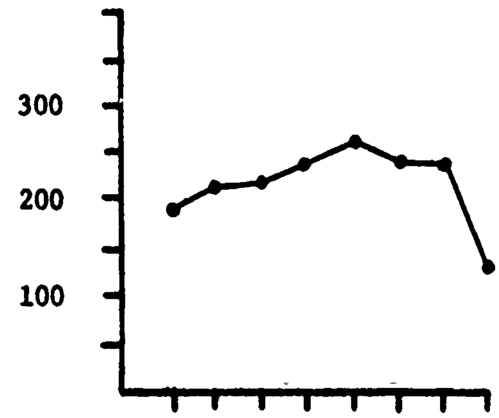
202

AH-1G MAJOR ITEMS TRENDS
OCTOBER 1, 1969 THRU SEPT 30, 1971
MEAN TIME TO REMOVAL (MTTR)

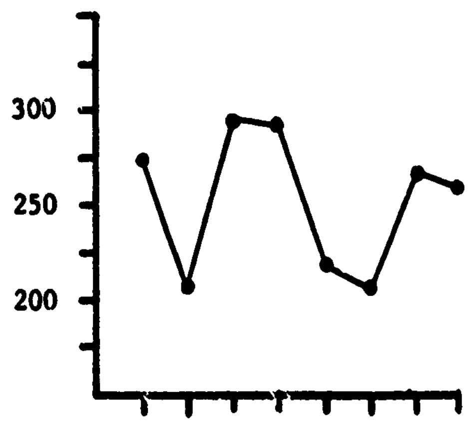
MAIN ROTOR BLADE
PN 5400110015



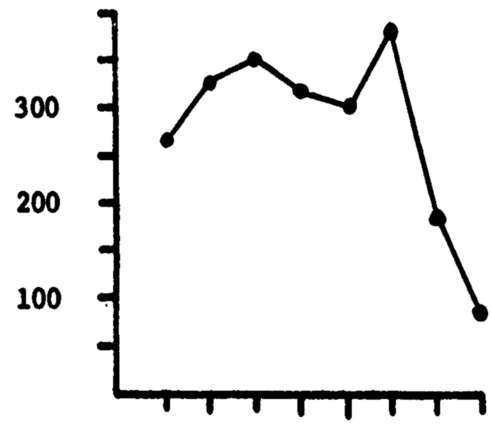
TAIL ROTOR BLADE
PN 20401170217



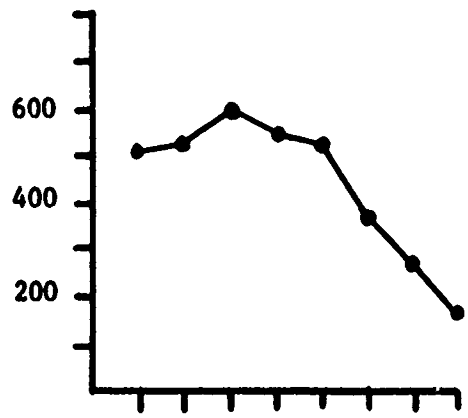
DRIVESHAFT
PN 2050400043



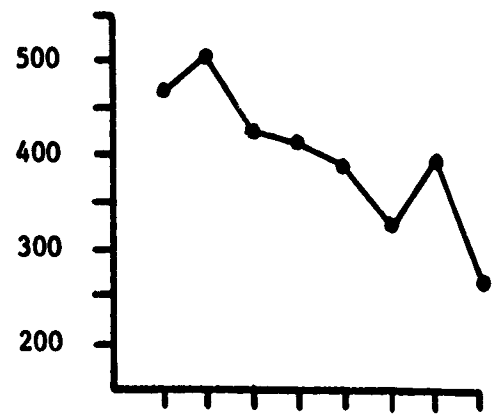
TURBINE ENGINE
PN 10000608



42° GEAR BOX
PN 20404000337

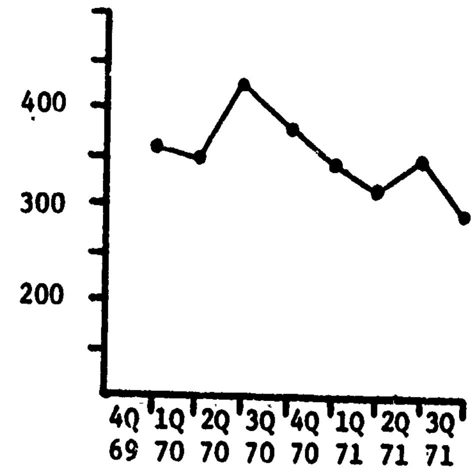


90° GEAR BOX
PN 20404001213

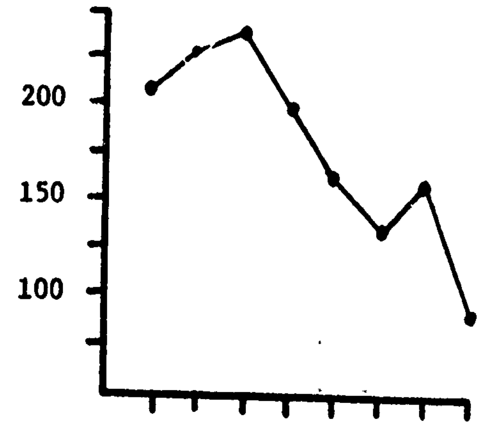


MEAN TIME TO REMOVAL (MTTR)

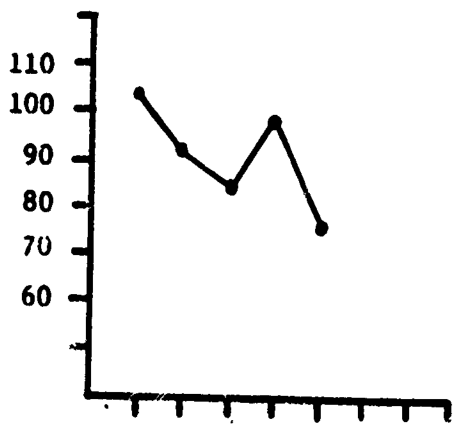
HANGER
PN 2040406009



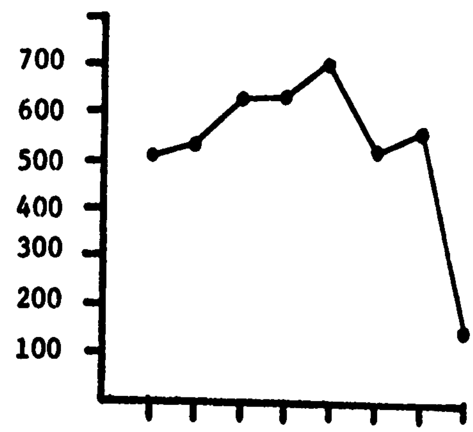
MAIN ROTOR HUB
PN 5400111015



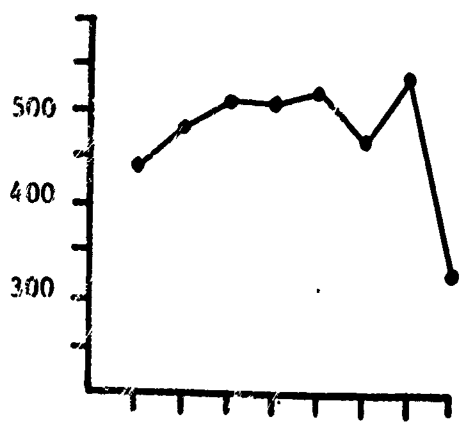
TAIL ROTOR HUB
PN 2090107013



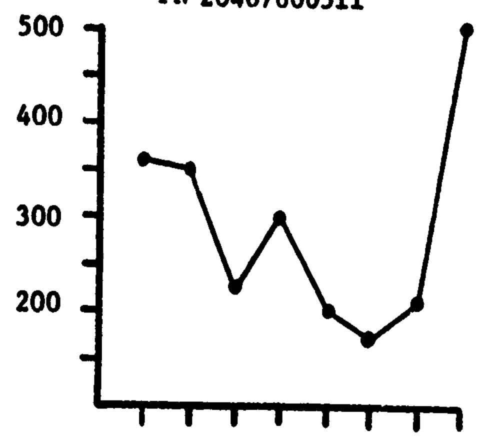
MAST
PN 2090403661



SCISSORS & SLEEVE
PN 2090104013

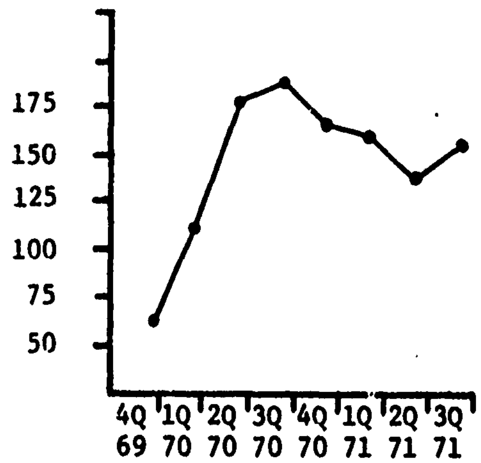


SERVO CYLINDER
PN 20407600511

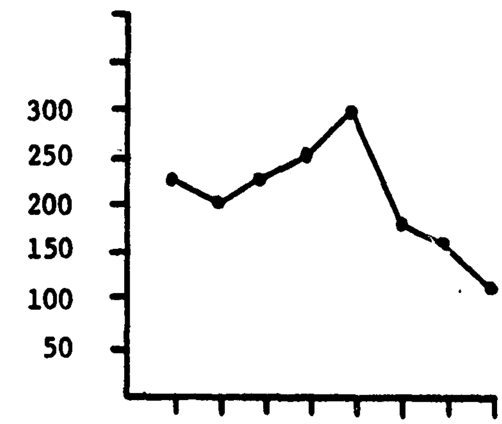


AH-1G MAJOR ITEMS TRENDS
OCTOBER 1, 1969 THRU SEPT 30, 1971
MEAN TIME TO REMOVAL (MTTR)

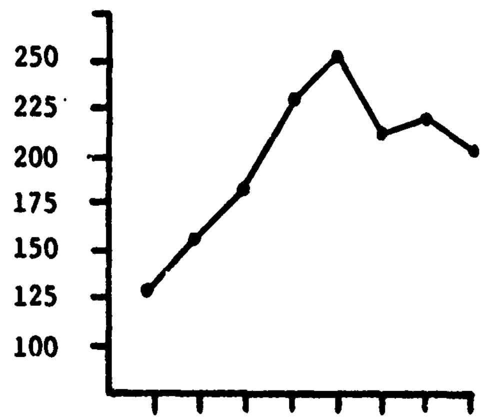
MAIN ROTOR BLADE
PN 5400112501



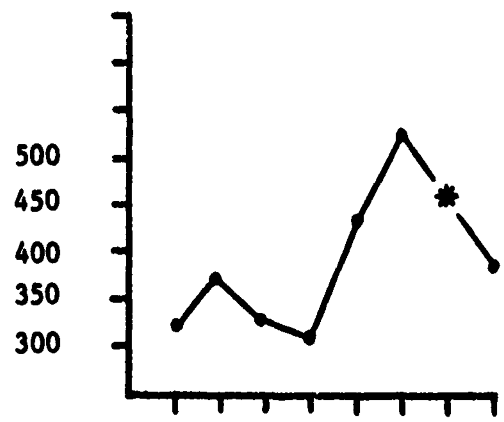
DRIVESHAFT
PN 2040400107



TAIL ROTOR HUB
PN 2040118013

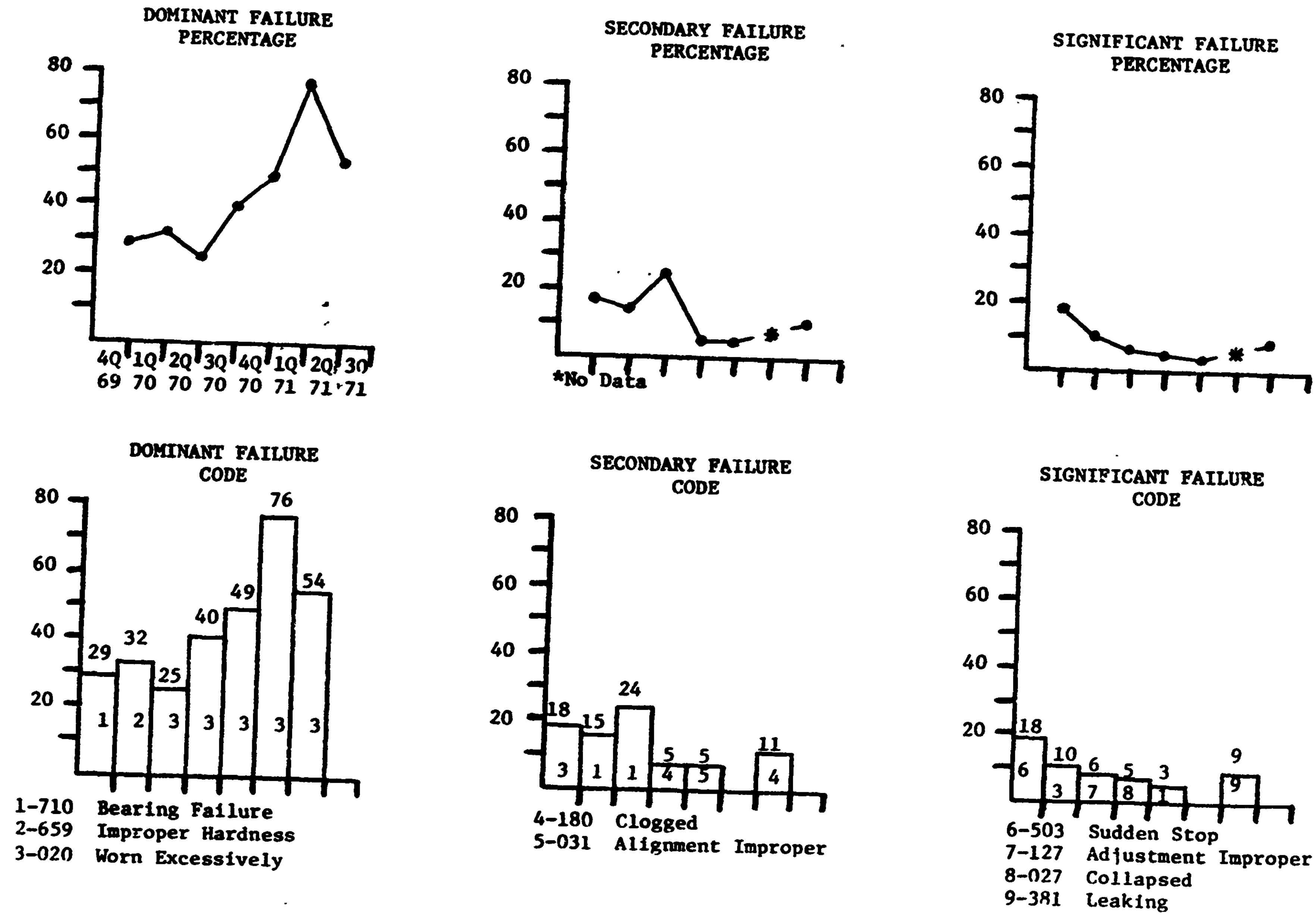


TURBINE ENGINE
PN 10000603



*No Data

FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
TAIL ROTOR HUB PN 2040118013



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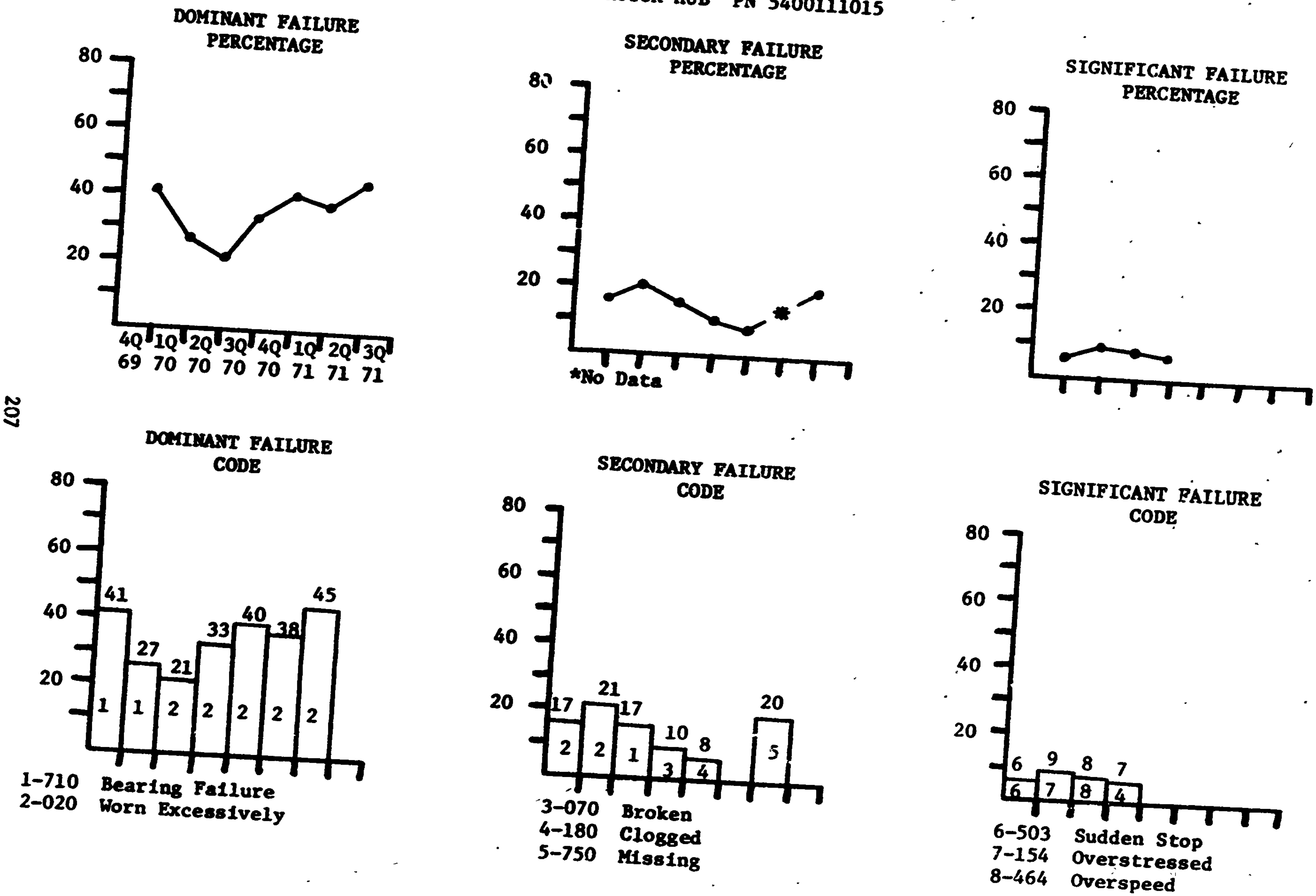
MAIN ROTOR HUB PN 5400111015



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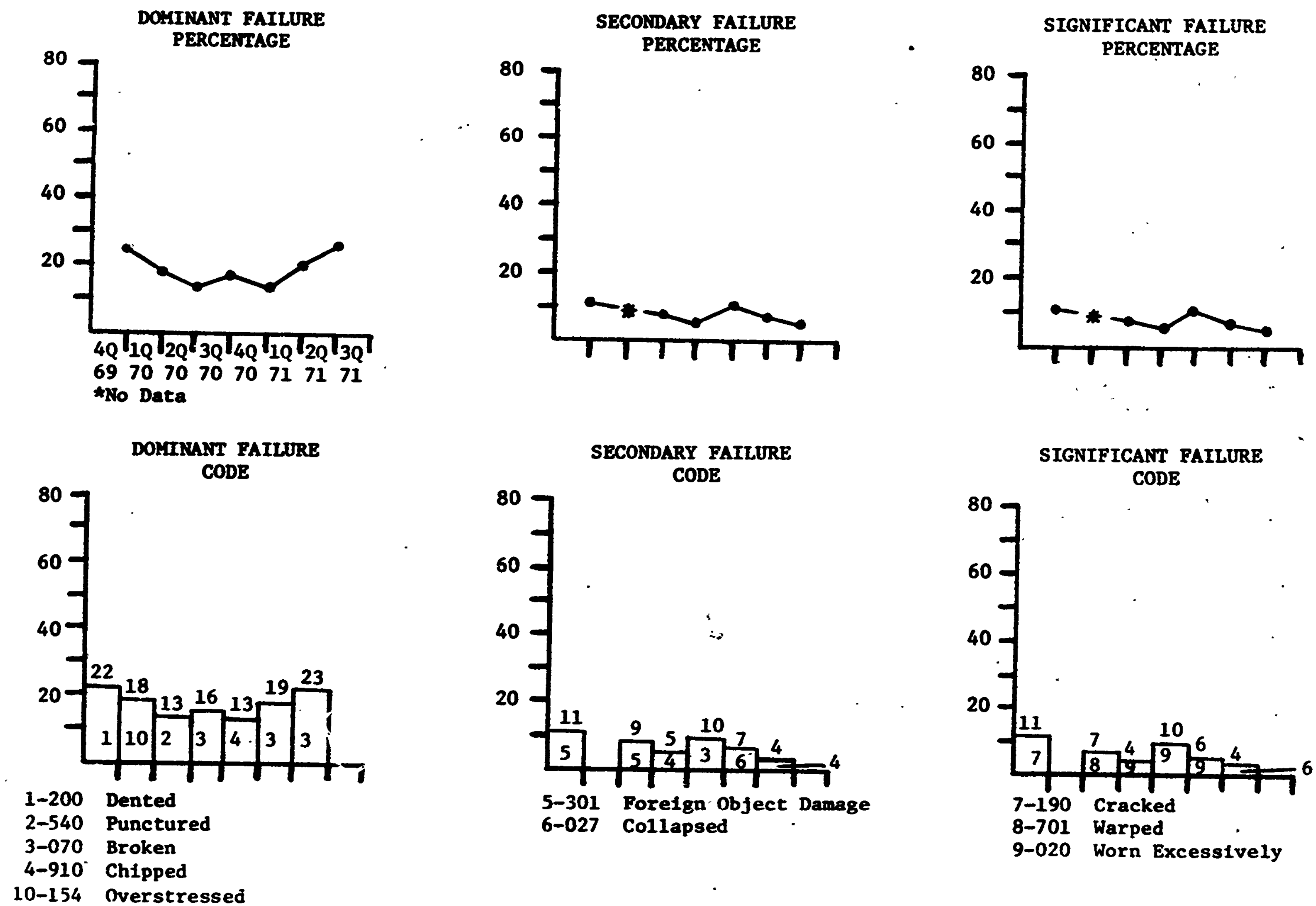
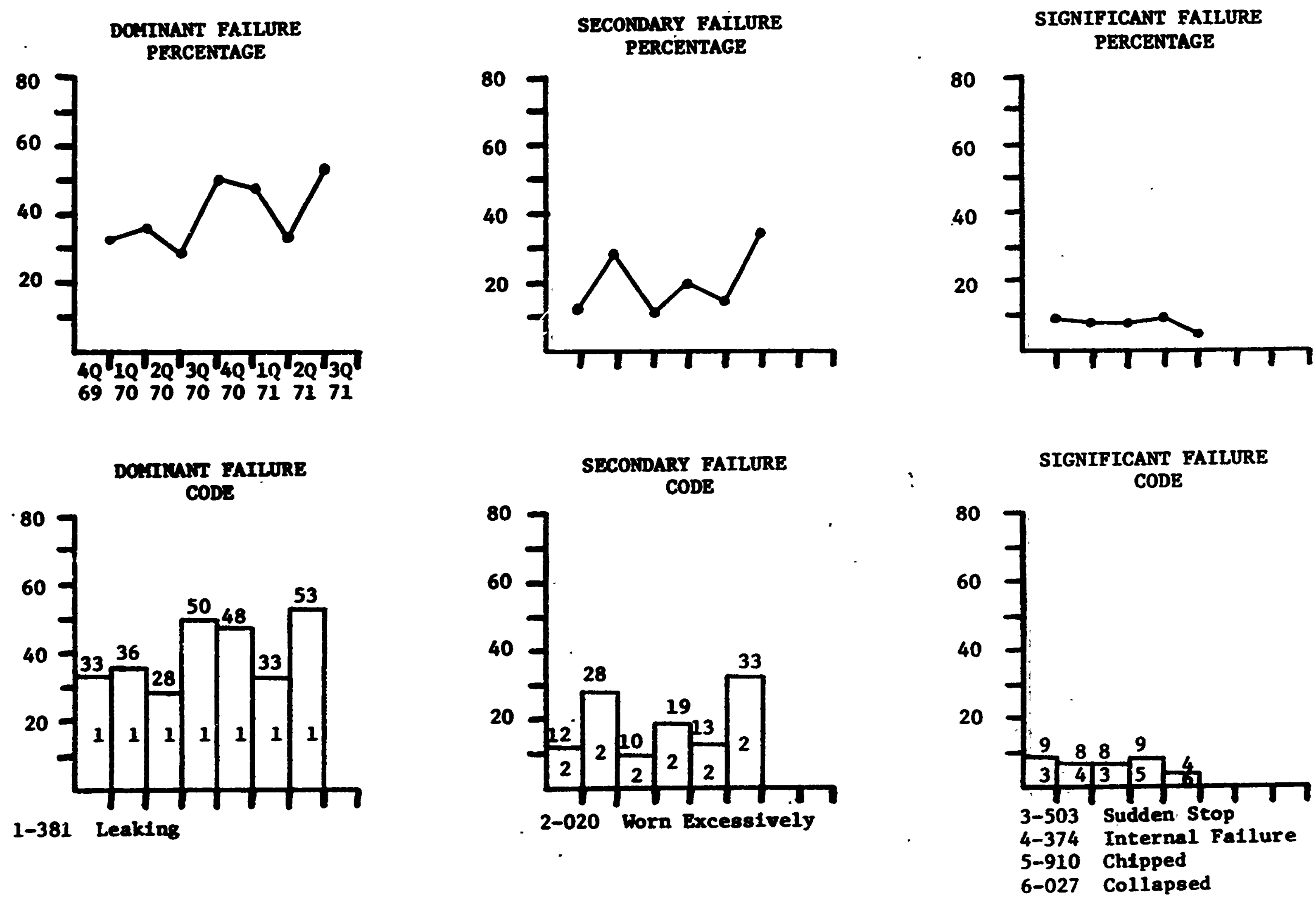
MAIN ROTOR BLADE PN 5400112501

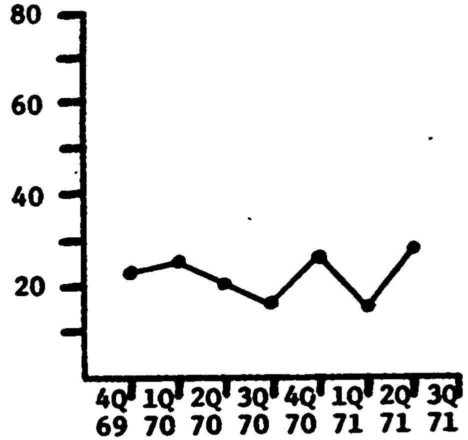


FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
42° GEAR BOX PN 20404000337

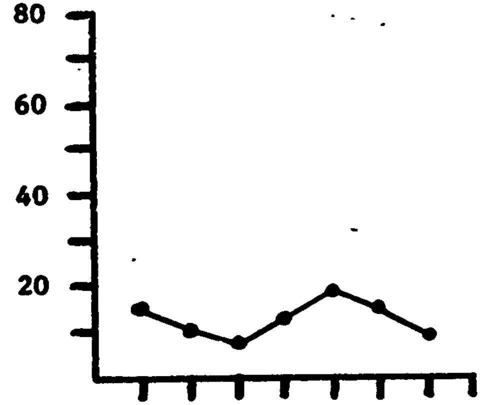


FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
TAIL ROTOR BLADE PN 20401170117

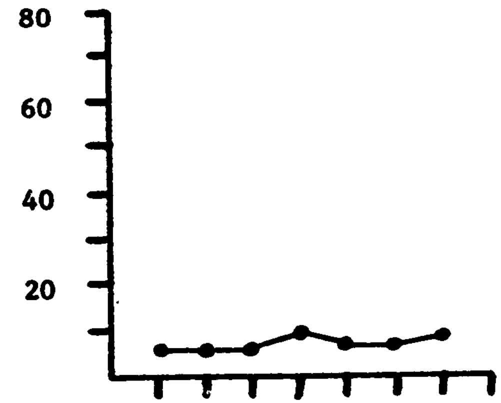
DOMINANT FAILURE PERCENTAGE



SECONDARY FAILURE PERCENTAGE



SIGNIFICANT FAILURE PERCENTAGE



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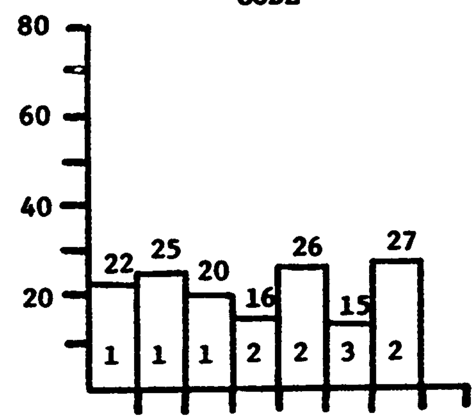
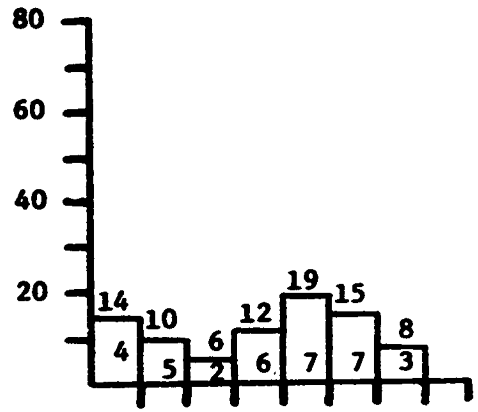


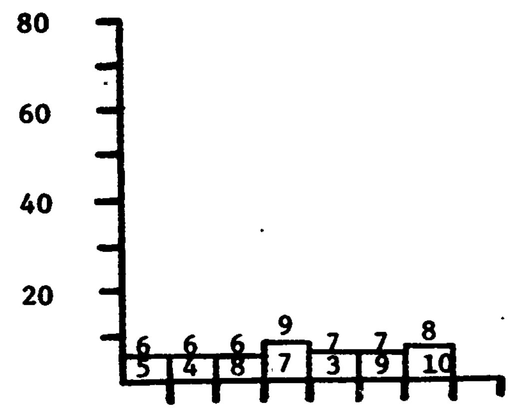
1-200 Dented
2-910 Chipped
3-020 Worn Excessively

SECONDARY FAILURE CODE



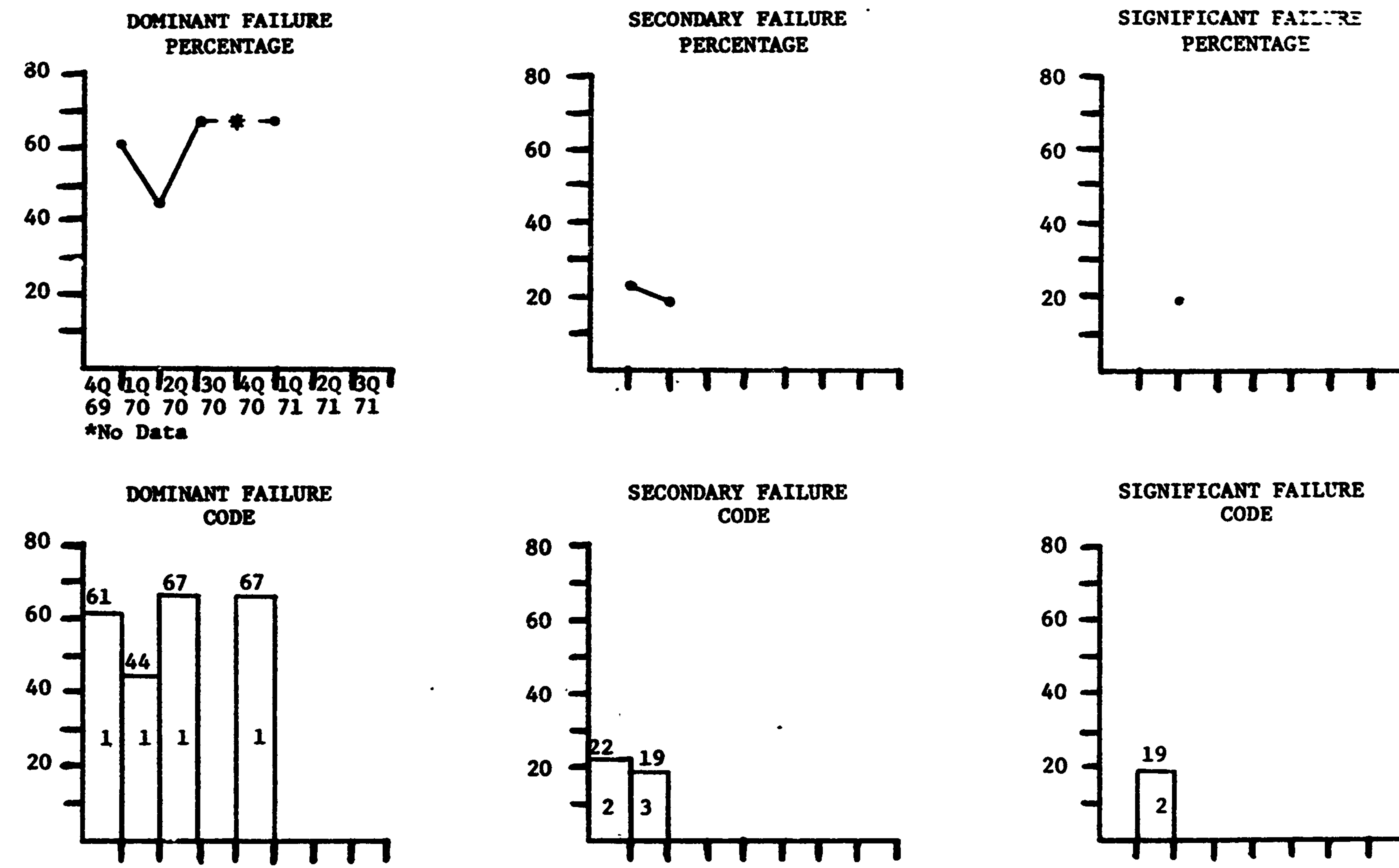
4-540 Punctured
5-503 Sudden Stop
6-200 Dented

SIGNIFICANT FAILURE CODE



8-301 Foreign Object Damage
9-127 Adjustment Improper
10-027 Collapsed

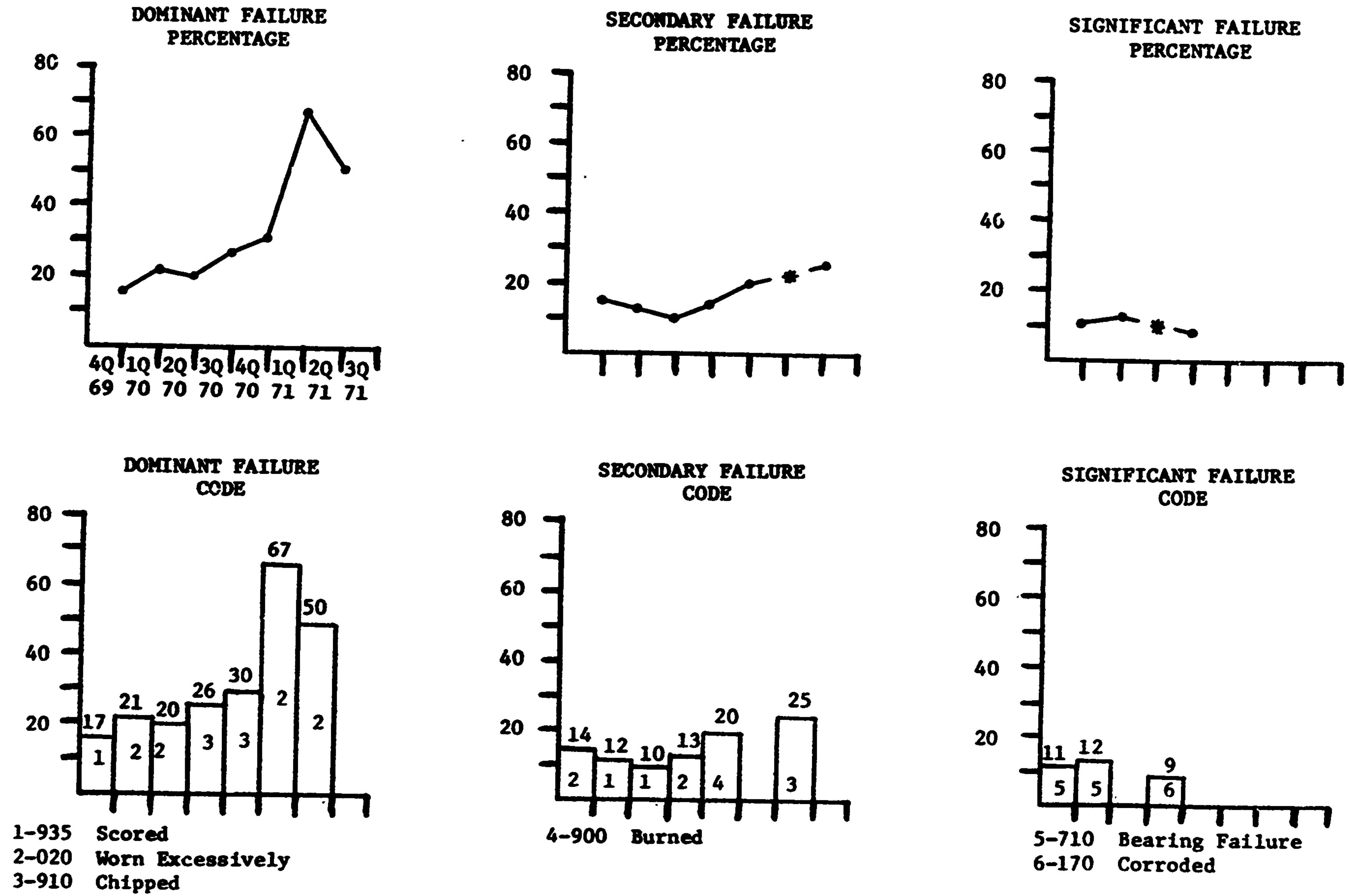
FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
SCISSORS & SLEEVE PN 2090104011



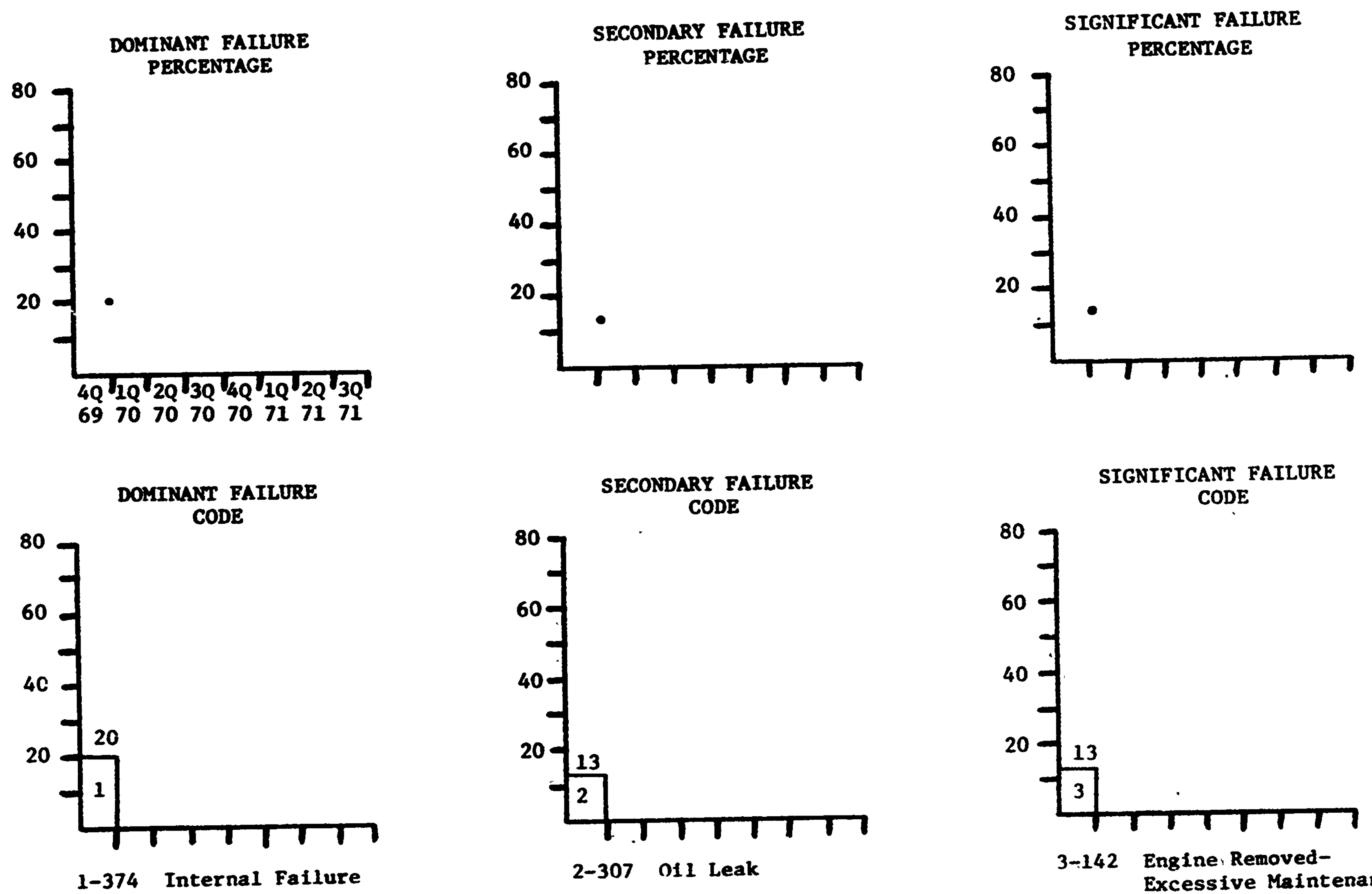
1-020 Worn Excessively

2-710 Bearing Failure
3-705 Beyond Specified Tolerance

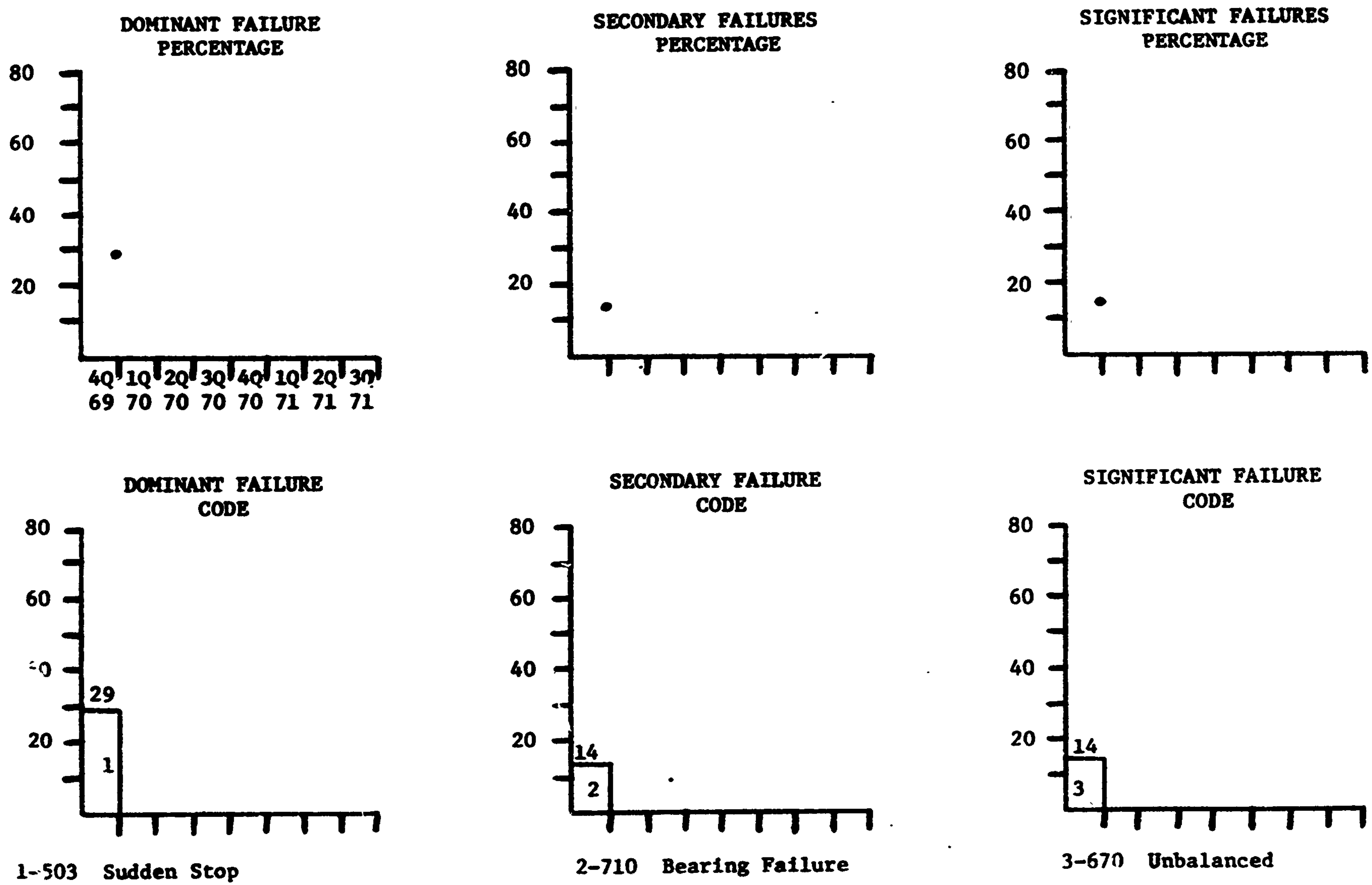
FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
MAST PN 2090403661



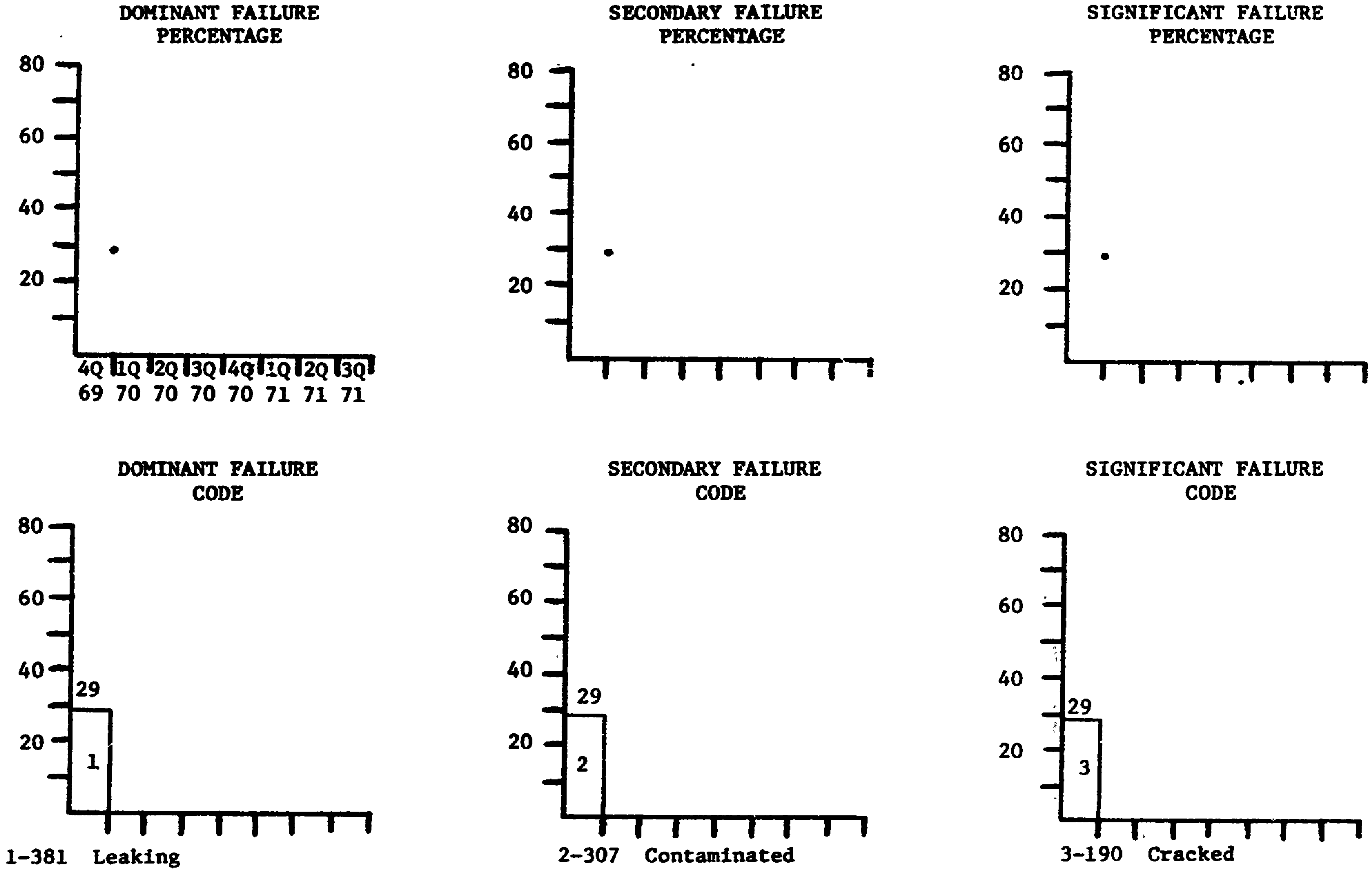
FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
TURBINE ENGINE PN 10000603



FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
TAIL ROTOR HUB PN 2090107013



FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
MAIN TRANSMISSION PN 2040400965



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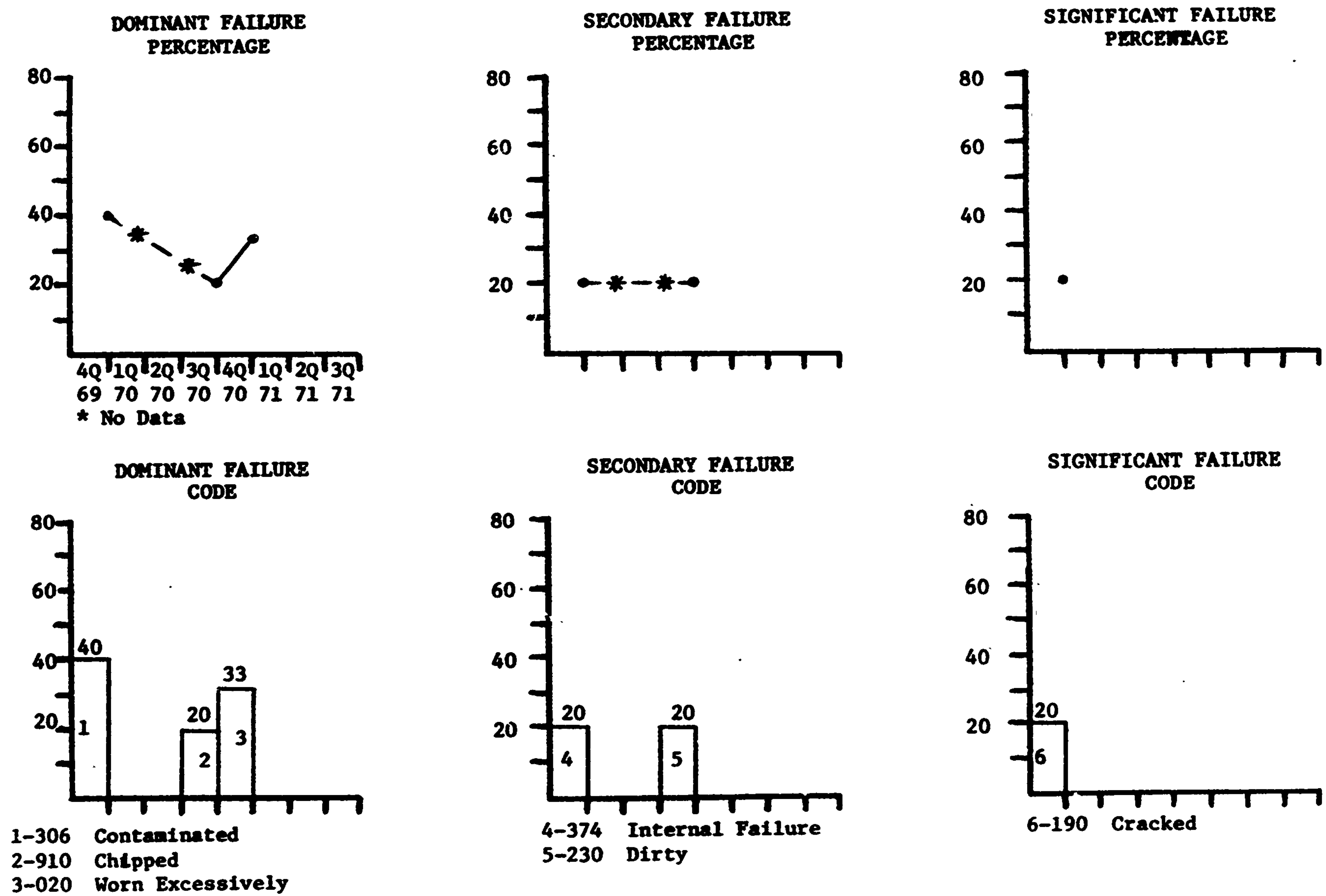
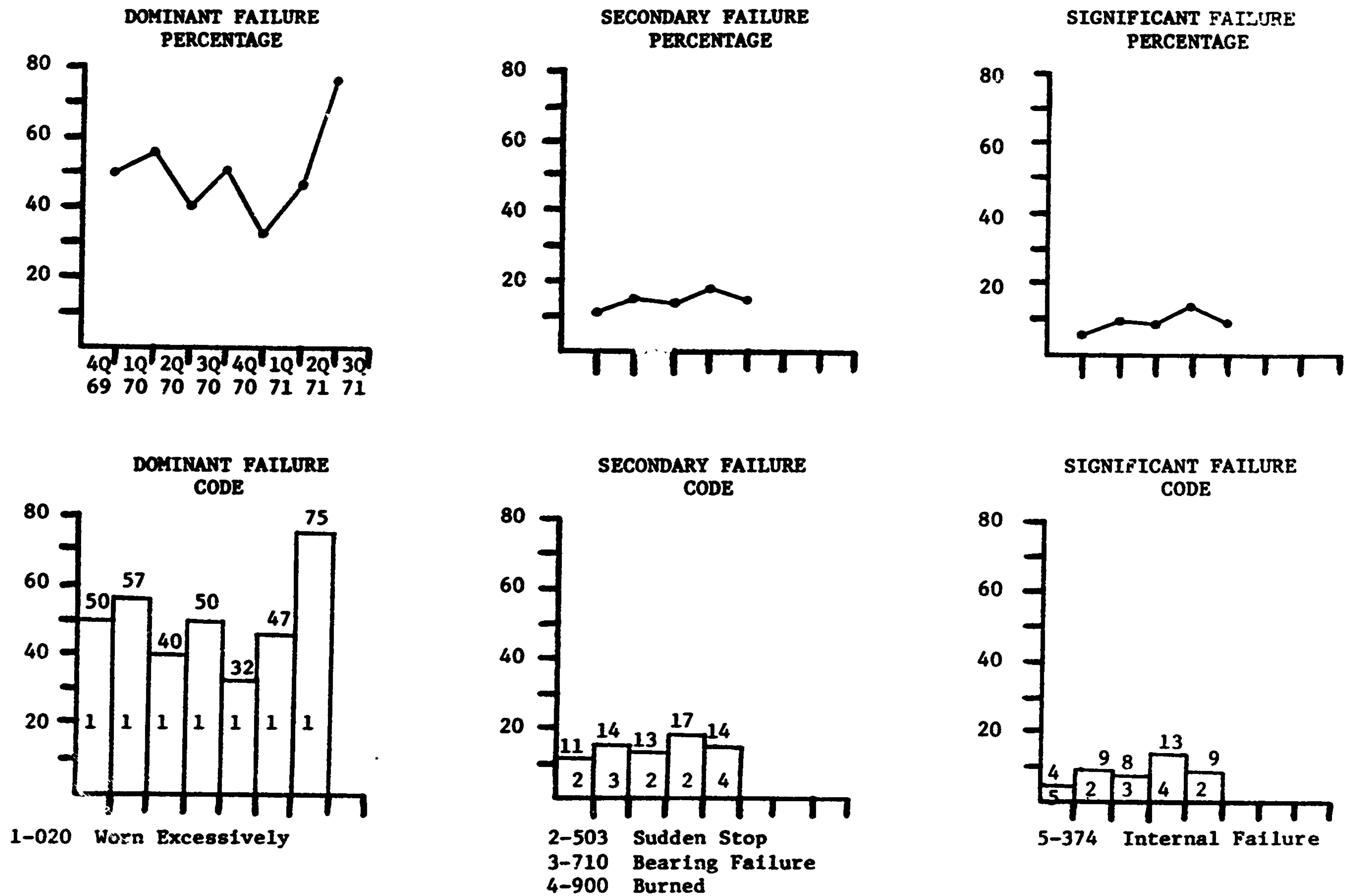
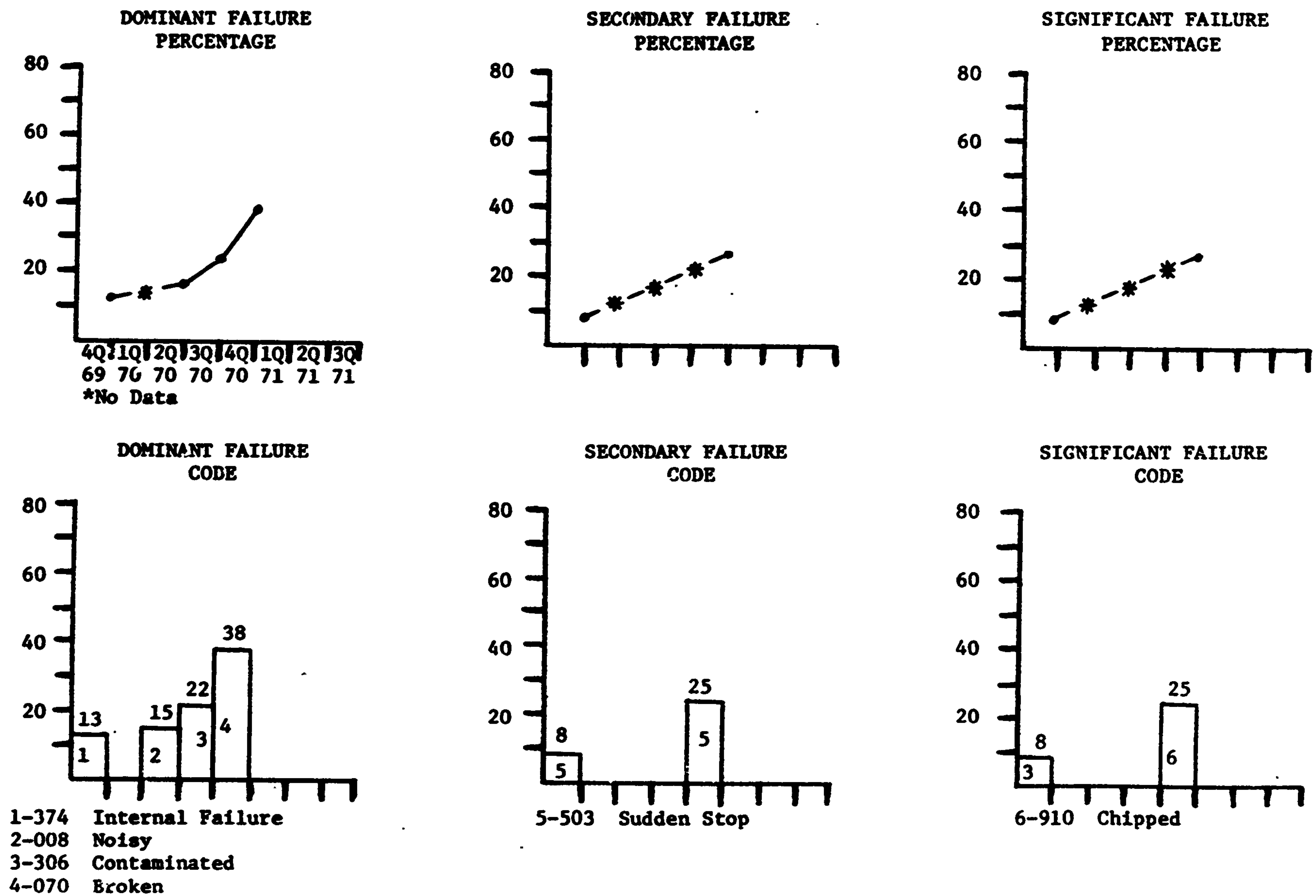
MAIN TRANSMISSION PN 2040400165



FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
SCISSORS & SLEEVE PN 2090104013

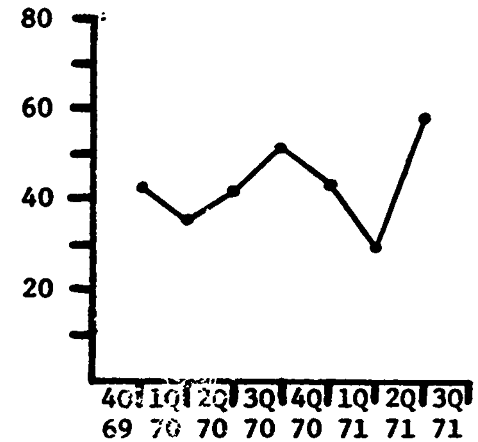


FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
MAIN TRANSMISSION PN 2040400161

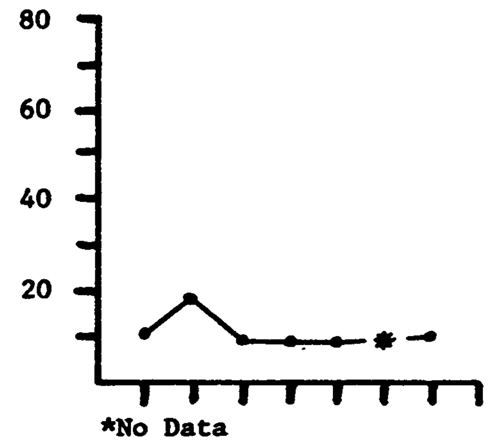


FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
SWASHPLATE & SUPPORT PN 2090104001

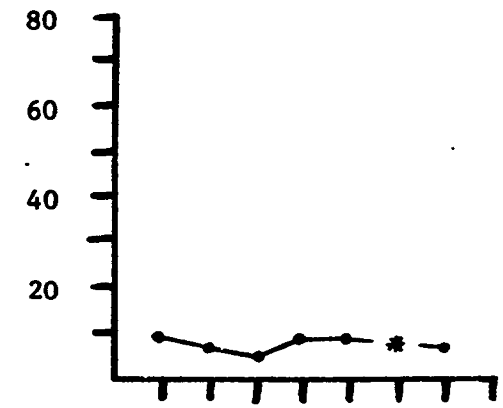
DOMINANT FAILURE PERCENTAGE



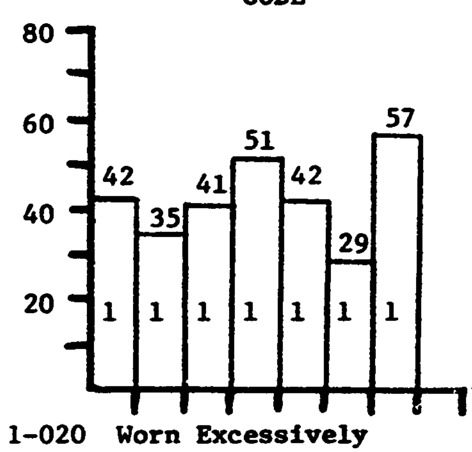
SECONDARY FAILURE PERCENTAGE



SIGNIFICANT FAILURE PERCENTAGE



DOMINANT FAILURE CODE



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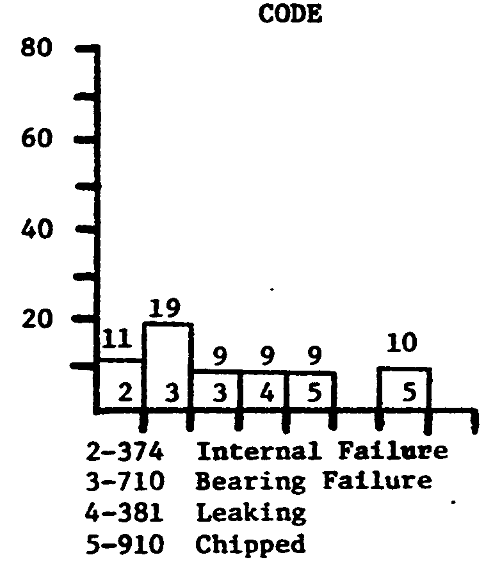
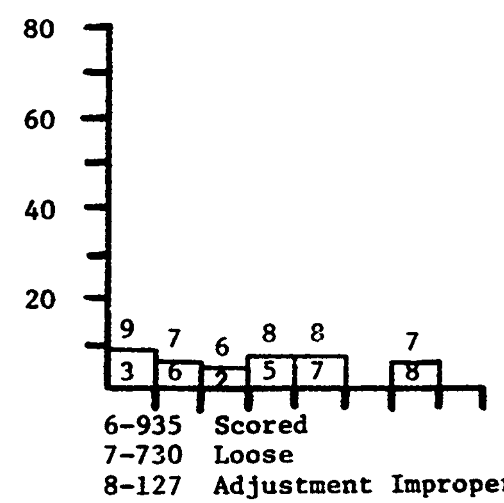
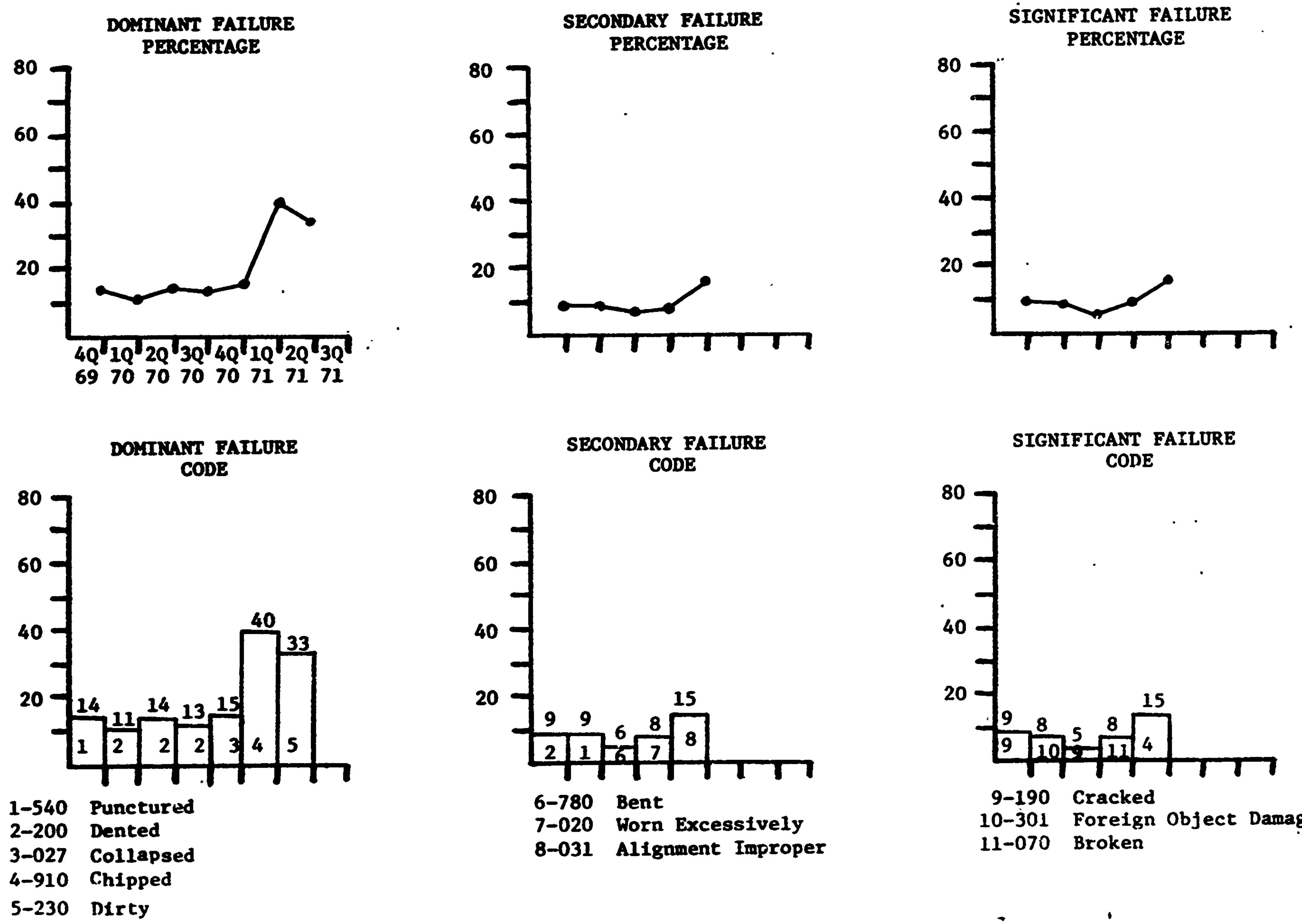


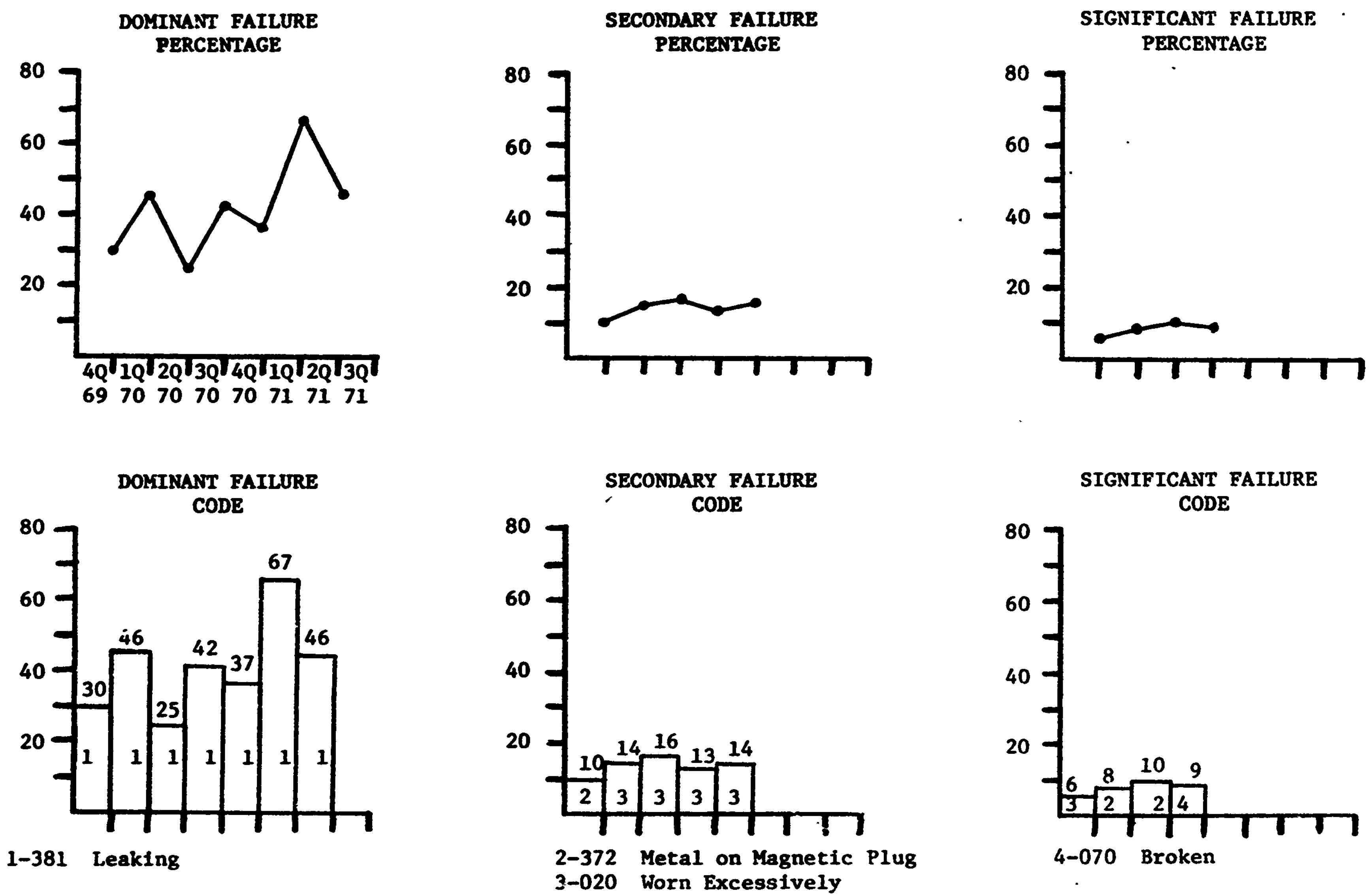
SIGNIFICANT FAILURE CODE



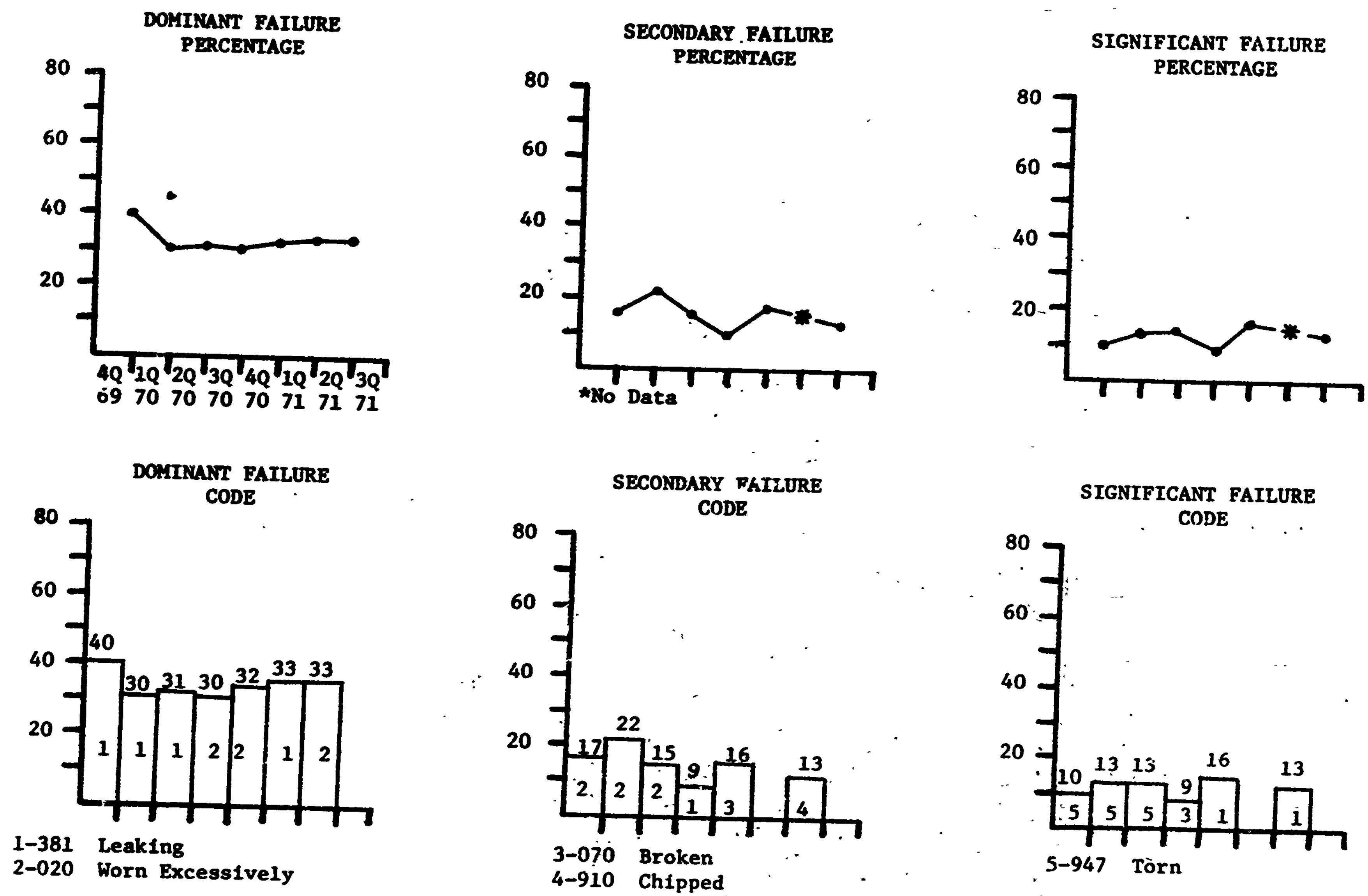
FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
MAIN ROTOR BLADE PN 5400110015



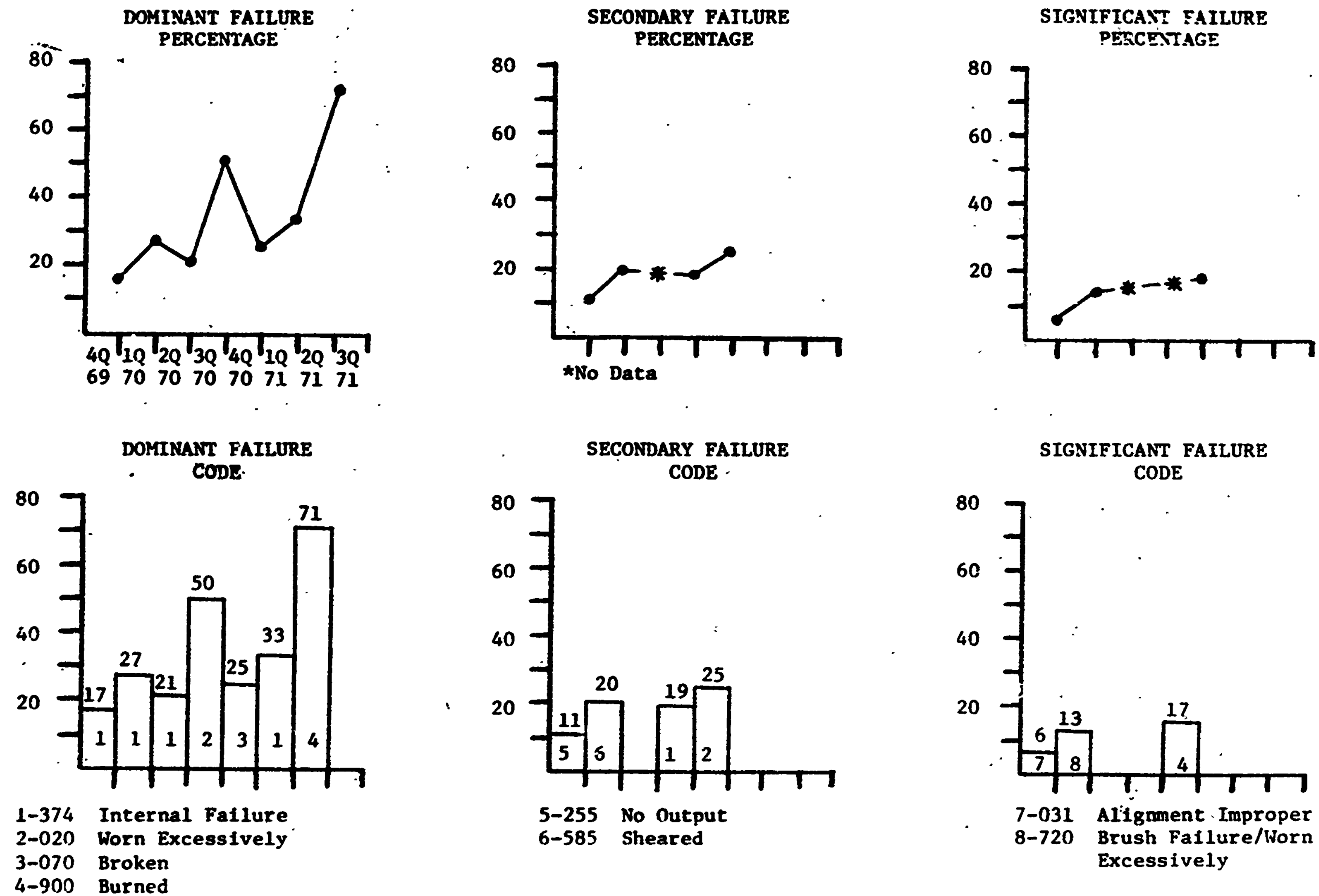
FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
90° GEAR BOX PN 20404001213



FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
MAIN DRIVESHAFT PN 2050400043



FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
STARTER GENERATOR PN 2040602001



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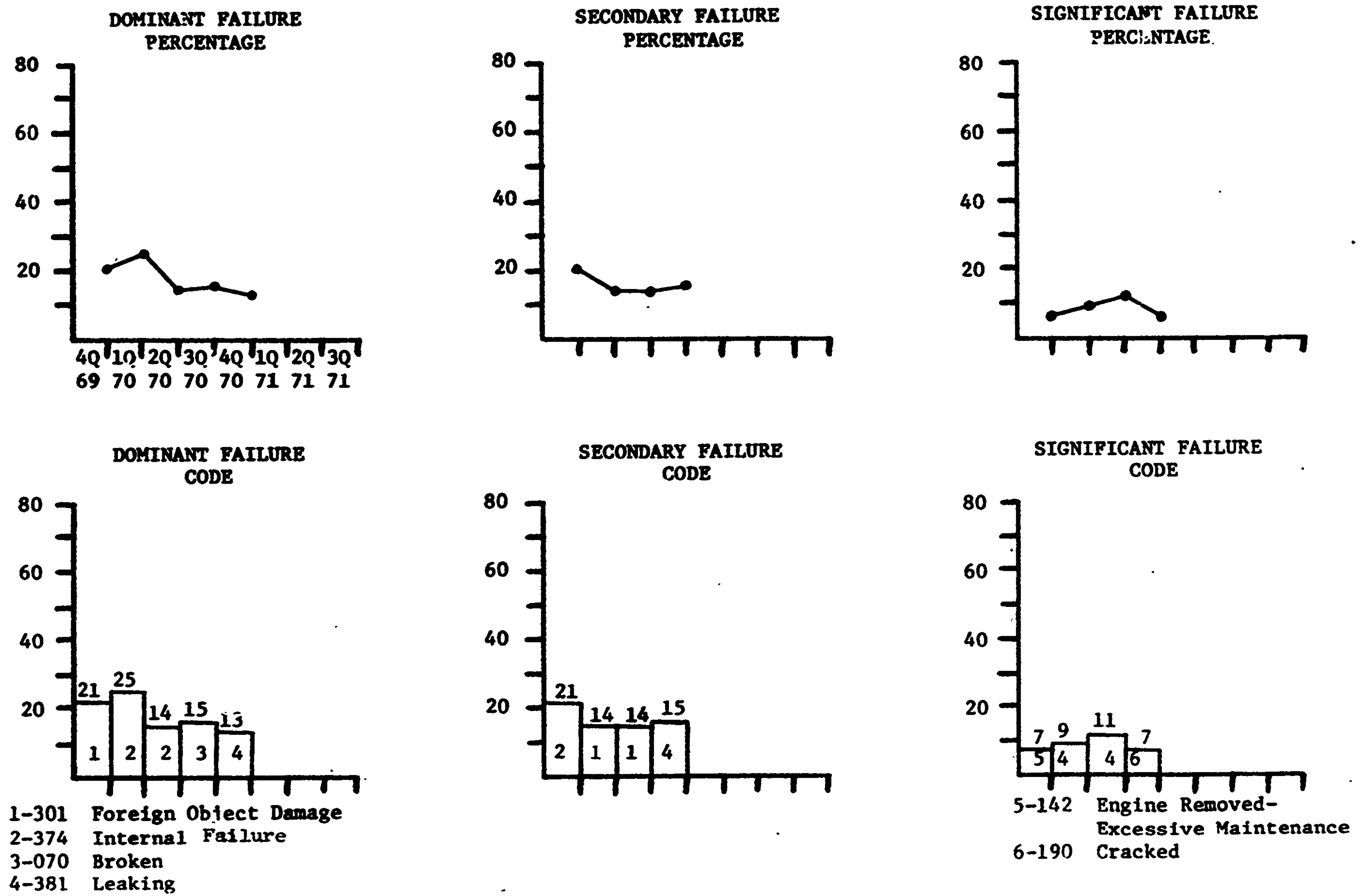
TURBINE ENGINE PN 10000608



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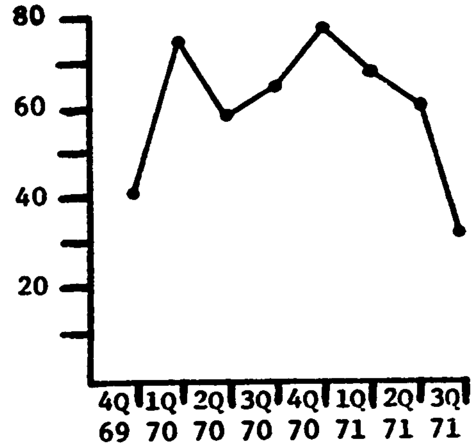
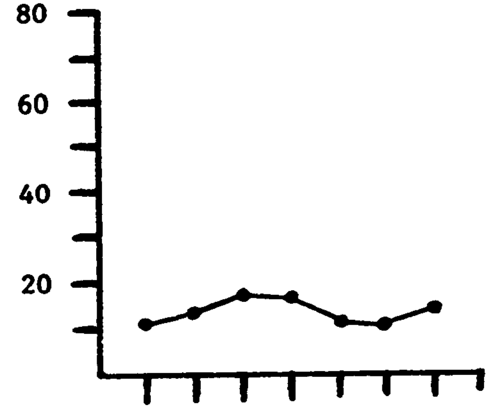
SERVO CYLINDER PN 20407600511

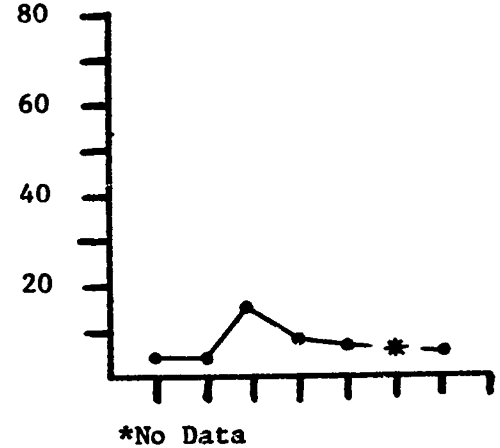
DOMINANT FAILURE PERCENTAGE



SECONDARY FAILURE PERCENTAGE



SIGNIFICANT FAILURE PERCENTAGE



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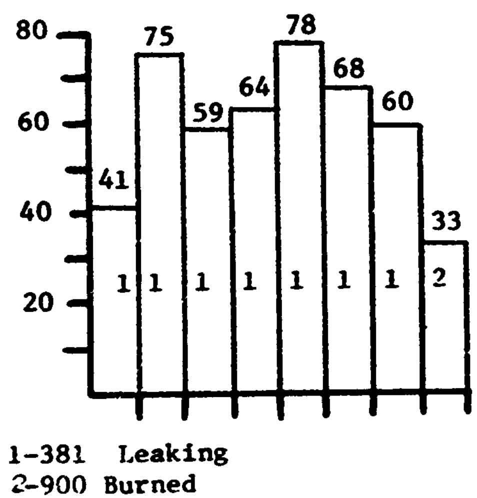

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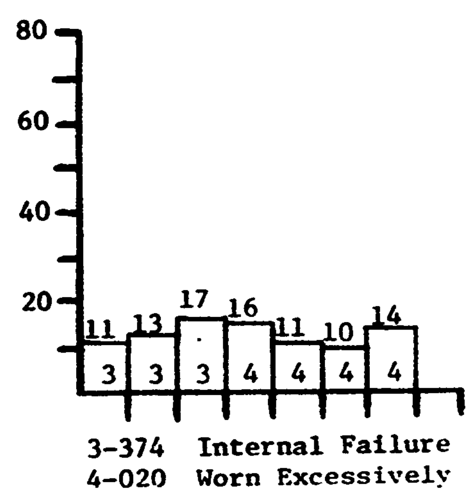

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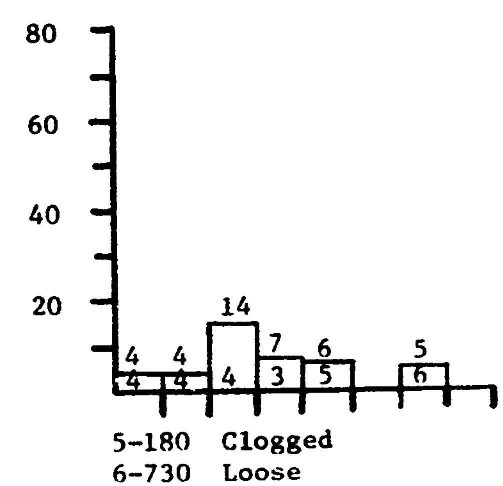
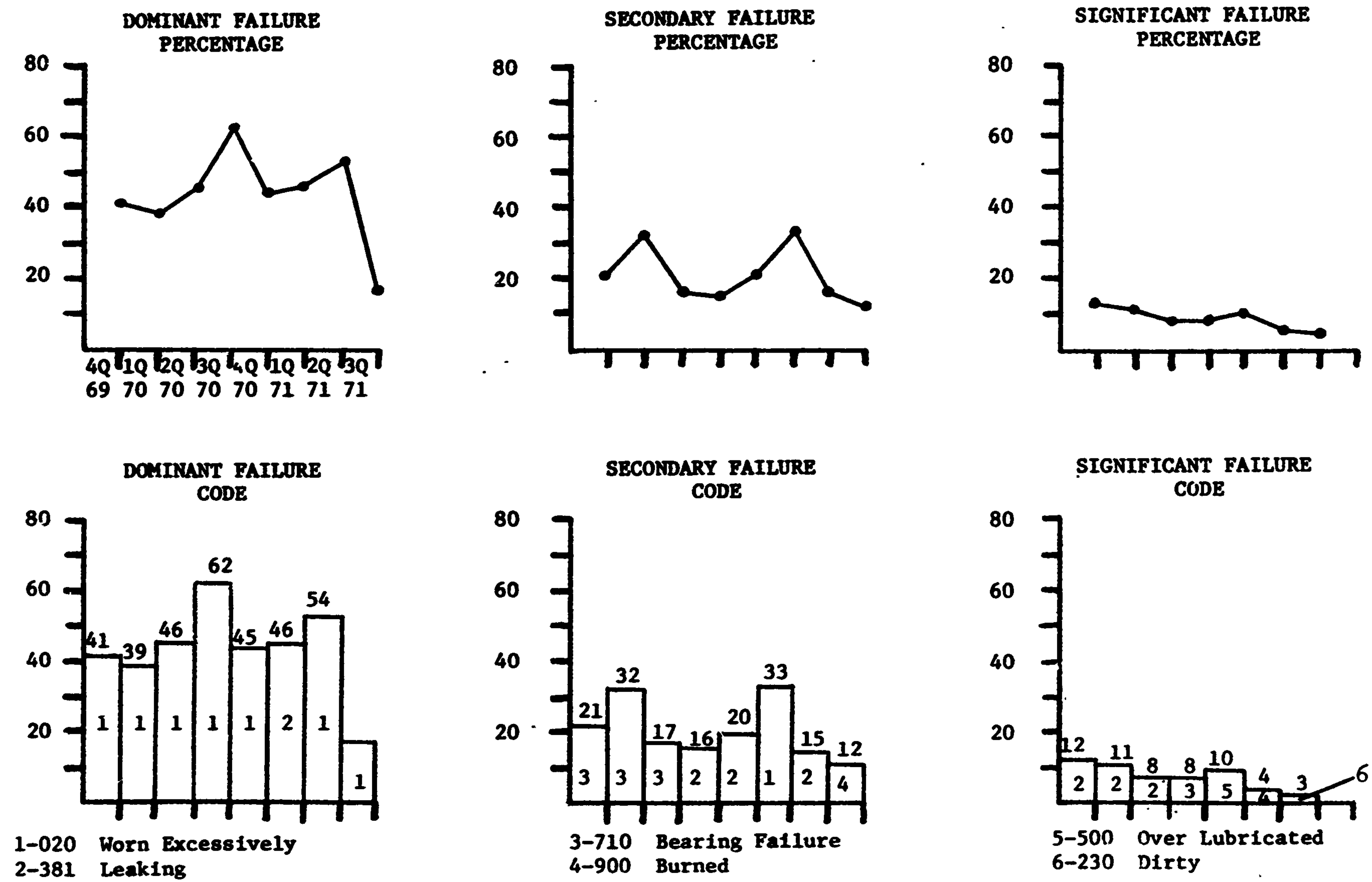
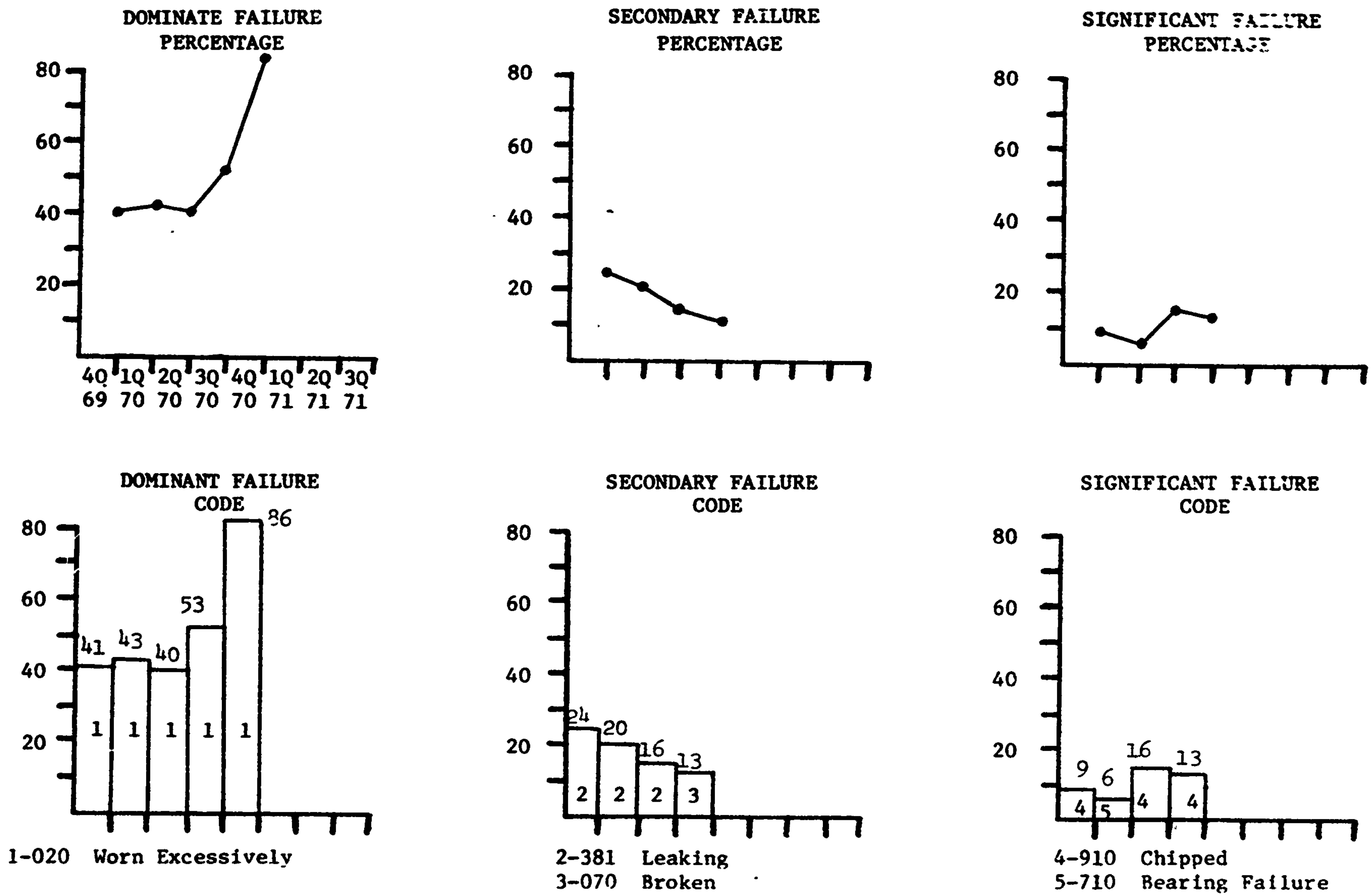


FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
TAIL ROTOR HANGER   PN 2040406009

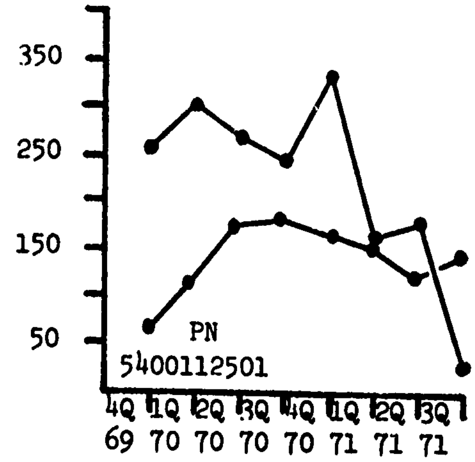


FIELD FAILURE PERCENTAGE REPORTED BY QUARTERS
MAIN DRIVESHAFT PN 2040400107

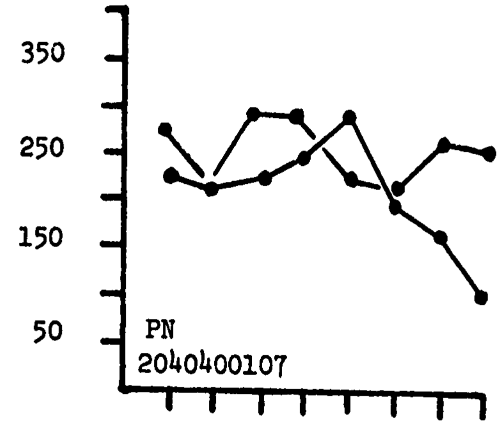


AH-1G MAJOR ITEMS TRENDS
OCTOBER 1, 1969 THRU SEPT 30, 1971
MEANTIME TO REMOVAL (MTTR)
OVERLAY

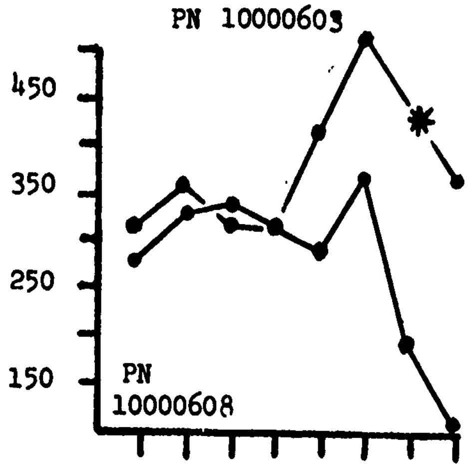
MAIN ROTOR BLADE
PN 5400110015



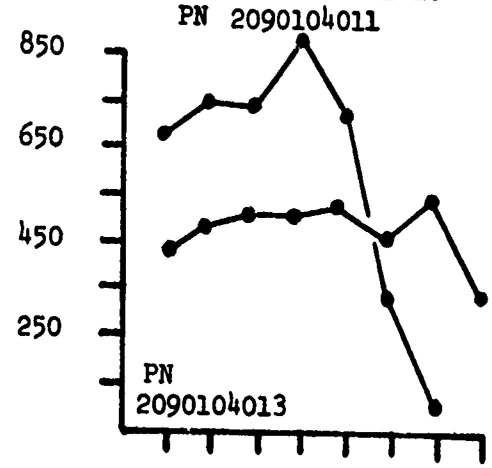
MAIN DRIVESHAFT
PN 2050400043



TURBINE ENGINES
PN 10000603



SCISSORS & SLEEVES
PN 2090104011



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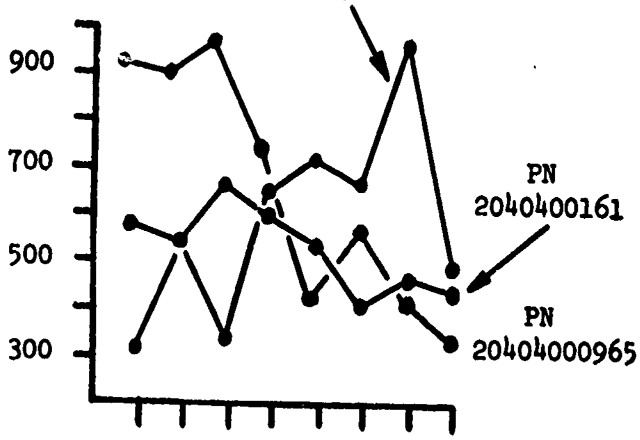
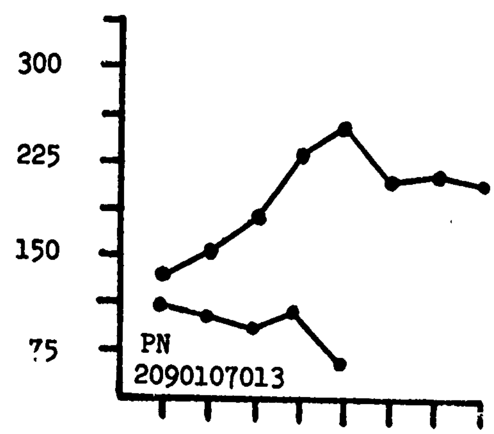
MAIN TRANSMISSIONS
PN 2040400165



TAIL ROTOR HUBS
PN 2040118013



OBSERVATIONS

In order to provide analysis and projections from the data displays, the introduction dates for various part numbered components must be known. These dates help establish when and where changes were accomplished; when items were retired from service and provide a time frame of effectivity from which to base recommendations or comments. Any steep downward slope in our graphs would reveal a lower MTR or phase-out of an item and a rapid increase in MTR would indicate the resulting improvement with the replacement item. Since the graphs do not indicate a start-up time, but rather a continuing usage of similar items, the observations will be based upon the average of the trend line.

MAIN ROTOR BLADE

The 540-011-250-1 main rotor blade was introduced in service during the latter part of 1969 and has indicated an average MTR of 162 hours since the second quarter of 1970. The 540-011-001-5 main rotor blade exhibited an MTR of 259 hours from 1969 to the third quarter of 1970. From this time period onward, it seems that the attrition cycle began with the 540-011-250-1 blade rapidly replacing the 540-011-001-5 blade. The MTR for the replacement blade was much less than the original blade, but obviously much greater improvements were made with the new blade.

MAIN DRIVE SHAFT

The 205-040-004-3 drive shaft exhibits an average MTR of 249 hours.

The 204-040-010-7 drive shaft was indicating an average MTR of 235 hours up to the fourth quarter of 1970 and then it sharply drops off. We assume this to be either attrition for the other drive shaft or the possible lack of all reported data for the last two calendar quarters for this item. In any case, the 205-040-004-3 drive shaft seems to be more reliable than the 204-040-010-7 drive shaft.

TURBINE ENGINE

The 10000608 turbine engine has an MTR of 324 hours for the first six quarters up to the first quarter of calendar 1971. After this point in time, the MTR drops off sharply. The 10000603 engine exhibits an MTR of 368 hours and is very good up to the second quarter of calendar 1971. This quarter then does not reflect any field data returns. This may be due to the DA Form 2410's which are still in process for data accumulation and not yet received here at AVSCOM.

SCISSORS AND SLEEVE

The 209-010-401-3 scissors and sleeve indicates a fairly stable MTR of 485 hours for the two year period. The 209-010-401-1 scissors and sleeve was lasting for an MTR averaging 767 hours, but the trend drops off drastically from the third quarter of 1970. This could not be so much of a lag in data but a trend of failures after 700 hours and/or it's subsequent replacement by attrition with the newer item.

MAIN TRANSMISSION

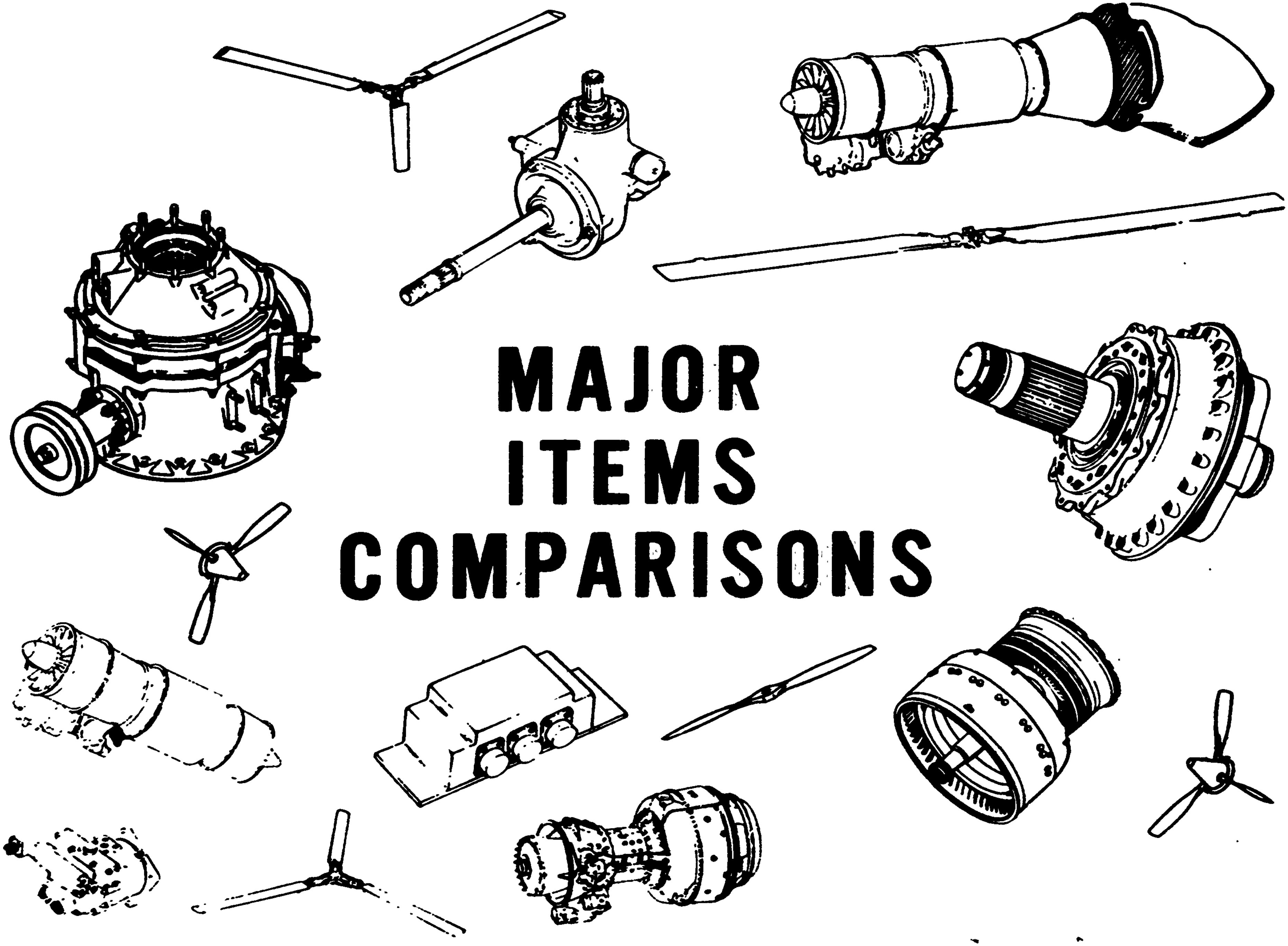
The MTR for all three transmissions was averaged for the first four quarters of data and then the display indicates drastic change. The 204-040-016-1 transmission revealed an initial MTR of 605 hours and then fell off to 450 hours by the third quarter of 1971. The 204-040-016-5 transmission had an MTR of 453 hours for the first four quarters, then improved to an MTR of 695 hours for the last four quarters. The 203-040-009-65 transmission MTR was averaging 880 hours the first four quarters and then rapidly fell off to 350 hours by the third quarter of 1971. From this it appears that the 204-040-016-5 transmission is the most reliable item, but in our analysis, we have not yet determined where to correlate this with the universal transmission to predict future reliability.

TAIL ROTOR HUB

The 209-010-701-3 tail rotor hub was obviously replaced by the fourth quarter of 1970 and it's average MTR was a scan 89 hours. The effect of the replacement of the 701 hub with the 204-011-801-3 tail rotor hub is visible with it's increased reliability and higher MTR of 169 hours.

These are the first indications of an analysis of historical data to show where improvements may have been made and how effective it was in relation to the previous experience. This analysis will improve as more data is available for the fourth quarter of 1971 and the first quarter of 1972.

MAJOR ITEMS COMPARISONS



(U) MAJOR ITEMS COMPARISON

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas.

Costs are associated with the MTR by using the latest available flight hour profiles on a given fleet to estimate an annual number of removals and, thus, a related cost. By calculating a potential MTR which could result from elimination of the selected failure modes, the number of annual removals is lowered and a potential cost savings derived. This cost savings is actually presented as a range of savings since the costs can be determined for both replacement with new components and replacements with overhauled components. In cases where a substantial percentage of the components are reaching the present TBO (time between overhaul), the MISS reports go a step further and calculate potential cost savings associated with extension of the TBO.

As more and more MISS reports are completed for similar components on different fleets of aircraft, it becomes possible to make comparisons between components and between fleets. The following tables are condensations of information available in MISS reports. It is recommended that the particular MISS reports be referred to for more detailed information and a more complete explanation of the methods used. Some of the MISS reports are based on a number of component configurations and, therefore, the particular reports should be consulted for specific part numbers and FSNs.

The "Present MTR" values are those quantities derived from the existing data. The next column presents the failure modes that were chosen to be investigated in the MISS reports. The "Potential Failure Elimination MTR" values are those that were calculated by assuming that the above mentioned failure modes could be eliminated. The potential cost savings are on an annual basis and related to the theoretical increase in MTR. The high value in each range assumes total replacement with new components and the low figure is based on complete replacement with overhauled items. The amount of cost savings is, of course, dependent on the size of the particular fleet and the number of annual flight hours.

The last four columns present the results of those MISS reports which included TBO extensions. Again there is an additional potential increase in MTR and an associated cost savings. The "Total Annual Potential Cost Savings" figure is based on both failure mode elimination and TBO extension.

With respect to the significant failure modes investigated, it must be noted that these failure codes are very general and not very descriptive. Therefore, further investigation would be necessary in order to obtain more specific information as to the actual causes of the major item failures. Also, it must be realized that the elimination of the same percentage of any other failures could result in a similar increase in MTR and annual cost savings.

TABLE 1
COMPARISON OF TURBINE ENGINES

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	351	F. O. D. Internal Oil/Fuel	59.7	471	$ 3,569,492 to $18,622,258	N/A	N/A	N/A	N/A
CH-47A	265	F. O. D. Internal Oil/Fuel	49.7	280	$ 918,299 to $ 3,142,219	N/A	N/A	N/A	N/A
CH-47A APU	231	Internal	42.0	288	$ 862,351	N/A	N/A	N/A	N/A
CH-54A									
CH-54A APU									
OH-58A	280	Internal Oil Related	23.5	316	$ 711,314 to $ 1,337,132	N/A	N/A	N/A	N/A
OH-6A									
UH-1H	350	F. O. D. Internal Oil/Fuel	60.9	477	$16,285,394 to $85,082,128	N/A	N/A	N/A	N/A
UH-1D	616	Internal	14.4	653	$ 576,802 to $ 2,956,465	N/A	N/A	N/A	N/A

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 2
COMPARISON OF TRANSMISSION ASSEMBLIES

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	574	Fractures: Broken/ Cracked	13.3	600	$ 81,628 to $337,548	1100	1300	[illegible]	$ 81,628 to $ 843,869
CH-47A	390	Oil Leaking	9.1	406	$ 27,013 to $11,649	N/A	N/A	N/A	N/A
CH-54A									
OH-58A	560	Leaking	20.0	628	$168,624 to $254,829	1200	1400	683	$ 168,624 to $ 422,289
OH-6A	382	Metal on Plug Internal Leaking	25.6	424	$308,318 to $732,038	N/A	N/A	N/A	N/A
UH-1D	750	Oil Leaking	7.6	768	$ 52,848 to $226,508	1100	1300	847	$ 52,848 to $1,096,774
UH-1H	807	Oil Leaking	6.3	823	$109,745 to $446,205	1100	1300	914	$ 109,745 to $2,809,181

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 3
COMPARISON OF MAIN ROTOR BLADES

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	281	Environment Cracking Bonding	43.3	361	$ 409,972 to $2,035,764	N/A	N/A	N/A	N/A
CH-47A	466	Environemnt Cracking Bonding	67.9	502	$ 128,214 to $ 279,420	N/A	N/A	N/A	N/A
CH-54A	428	Environment Cracked	30.7	517	$ 98,422 to $ 346,142	N/A	N/A	N/A	N/A
OH-58A	406	Cracking Bonding	22.5	436	$ 73,110 to $ 131,762	N/A	N/A	N/A	N/A
OH-6A	295	Erosion	36.2	336	$ 641,350	N/A	N/A	N/A	N/A
UH-1D	386	Environment Cracking Bonding	58.8	523	$ 650,940 to $2,690,885	N/A	N/A	N/A	N/A
UH-1H	348	Environment Cracking Bonding	59.0	460	$1,819,480 to $7,503,793	N/A	N/A	N/A	N/A

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 4
COMPARISON OF MAIN ROTOR HUBS

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	313	Bearing Worn Excess. Cracked	49.4	382	$ 684,771 to $2,345,713	N/A	N/A	N/A	N/A
CH-47A	607	Leaking	36.1	645	$ 79,805 to $ 287,477	N/A	N/A	N/A	N/A
CH-54A									
OH-58A	598	Leaking	40.0	707	$ 71,090 to $ 107,614	N/A	N/A	N/A	N/A
OH-6A	393	Excessive Wear	21.4	447	$ 419,822 to $ 580,656	N/A	N/A	N/A	N/A
UH-1D	506	Oil Leak	37.6	618	$ 340,218 to $ 802,683	1100	1300	666	$ 340,218 to $1,064,022
UH-1H	525	Oil Leak	37.2	636	$ 854,502 to $2,016,042	1100	1300	688	$ 854,502 to $2,732,111

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 5
COMPARISON OF TAIL ROTOR BLADE

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	226	Environment	42.3	296	$ 314,896	N/A	N/A	N/A	N/A
CH-47A									
CH-54A									
OH-58A	464	Material	31.0	628	$ 303,645	N/A	N/A	N/A	N/A
OH-6A									
UH-1D	415	Environment Cracking	60.0	615	$ 270,679	1100	1300	664	$ 312,100
UH-1H	402	Environment	41.7	5.4	$ 700,444	N/A	N/A	N/A	N/A

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 6
COMPARISON OF TAIL ROTOR HUB

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	260	Excessive Wear	37.5	297	$ 109,342	N/A	N/A	N/A	N/A
CH-47A									
CH-54A									
OH-58A									
OH-6A									
UH-1D	332	Excessive Wear	23.5	379	$ 126,218	N/A	N/A	N/A	N/A
UH-1H	214	Excessive Wear	29.8	227	$ 314,824	N/A	N/A	N/A	N/A

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 7
COMPARISON OF TAIL ROTOR GEAR BOX (90°)

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	548	Oil Related	31.0	638	\$ 50,923 to \$ 160,533	1100	1300	688	\$ 50,923 to \$231,697
CH-54A									
OH-58A	426	Leaking	46.8	551	\$ 86,291 to \$ 127,919	N/A	N/A	N/A	N/A
OH-6A	334	Leaking	20.3	374	\$ 85,572 to \$ 142,275	N/A	N/A	N/A	N/A
UH-1D	685	Oil Related	28.9	767	\$ 44,509 to \$ 150,729	1100	1300	842	\$ 44,509 to \$261,371
UH-1H	649	Oil Related	33.9	747	\$ 159,044 to \$ 529,684	1100	1300	812	\$159,044 to \$810,675

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 8
COMPARISON OF SERVOCYLINDERS

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	359	Leaking	54.4	487	$1,391,061	N/A	N/A	N/A	N/A
CH-47A									
CH-54A									
OH-6A									
UH-1D									
UH-1H	387	Leaking	78.4	568	$ 285,169 to $ 611,153	N/A	N/A	N/A	N/A
OH-58A									

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N investigated.

TABLE 9
COMPARISON OF HANGER ASSEMBLIES

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	448	Excessive Wear	47.4	566	\$ 40,669 to \$ 122,152	N/A	N/A	N/A	N/A
CH-47A									
CH-54A									
OH-58A									
OH-6A									
UH-1D	433	Excessive Wear	69.4	623	\$ 78,026 to \$ 306,662	N/A	N/A	N/A	N/A
UH-1H	519	Excessive Wear Bearing	64.9	718	\$ 259,089 to \$ 803,408	N/A	N/A	N/A	N/A

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 10
COMPARISON OF 42° GEAR BOX

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	530	Oil Related	41.5	699	\$ 58,931 to \$ 203,933	1500	1700	719	\$ 58,931 to \$ 222,033
UH-1D	786	Oil Related	39.7	956	\$ 45,649 to \$ 161,479	1500	1700	1003	\$ 45,649 to \$ 197,363
UH-1H	665	Leaking	46.0	866	\$ 193,035 to \$ 679,521	1500	1700	915	\$ 193,035 to \$ 799,366

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 11
COMPARISON OF SWASHPLATF AND SUPPORT

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	494	Excessive Wear	37.0	581	\$ 68,622 to \$157,550	N/A	N/A	N/A	N/A
CH-47A	643	Excessive Wear	51.9	697	\$293,876 to \$646,991	N/A	N/A	N/A	N/A
CH-54A									
OH-58A									
OH-6A									
UH-1D	721	Excessive Wear Bearing	46.7	803	\$32,685 to \$82,383	N/A	N/A	N/A	N/A
UH-1H									

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 12
COMPARISON OF DRIVESHAFT, ENGINE TO TRANSMISSION

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	315	Oil Related	29.1	350	$ 37,713 to $167,041	N/A	N/A	N/A	N/A
CH-47A									
CH-54A									
CH-58A									
OH-6A									
UH-1D	375	Excessive Wear Oil Leaking	40.2	488	$117,827 to $523,347	N/A	N/A	N/A	N/A
UH-1H	285	Excessive Wear Oil Leaking	43.9	368	$ 413,448 to $1,821,808	N/A	N/A	N/A	N/A

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

TABLE 13
COMPARISON OF MAST ASSEMBLY

AIRCRAFT *	PRESENT MTR	SIGNIFICANT FAILURE MODES	PERCENT OF FAILURES	POTENTIAL FAILURE ELIMINATION MTR	ANNUAL POTENTIAL COST SAVINGS RANGE	PRESENT TBO (FLT HRS)	EXTENDED TBO (FLT HRS)	POTENTIAL TBO EXTENSION MTR	TOTAL POTENTIAL SAVINGS RANGE (ANNUAL)
AH-1G	490	Excessive Wear	22.2	546	$ 38,958 to $ 92,319	1100	1300	576	$ 38,958 to $135,081
OH-58A									
UH-1D	816	Excessive Wear	18.4	853	$ 15,463 to $ 34,023	1100	1300	628	$ 15,463 to $113,766
UH-1H	746	Excessive Wear	13.2	779	$ 45,034 to $ 98,394	1100	1300	850	$ 45,034 to $285,556

*NOTE: See applicable Major Item Special Study (MISS) Report for particular component configuration (FSN and P/N) investigated.

OBSERVATIONS

1. Of the six turbine engines presented, the CH-47A has the lowest present MTR. Note that none of the engines had a high enough percentage reaching TBO to warrant a TBO extension. The auxiliary power unit (APU) for the CH-47A is also included in this group of turbine engines.

2. There are five different transmissions on the CH-47A aircraft. The particular one investigated here is the mechanical engine transmission. The UH-1D and UH-1H transmission assemblies appear to be performing relatively well, in comparison to the other transmissions. The consideration of TBO extensions for these two components might prove worthwhile. The OH-6A transmission data indicates that a problem exists with this component. Approximately 26% of these transmissions are failing due to metal on the magnetic plug and internal leakage.

3. Of the main rotor blades analyzed, the data reveals that the AH-1G blades have the poorest reliability with an MTR of 281 flight hours. For all blades presented, a very high percentage of the failures were due to environment, cracking or bonding problems. A special study (MISS) report was developed in January to recommend a Product Improvement Program (PIP) for the OH-6A main rotor blade erosion problem.

4. The AH-1G main rotor hub exhibits considerably low reliability in comparison to the UH-1D/H. The UH-1D and UH-1H hubs appear to be possible TBO extension candidates.

5. Similar to the main rotor blade on the AH-1G, the tail rotor blade is very short lived in service. Its mean time to removal is approximately half that of other tail rotor blades on similar aircraft.

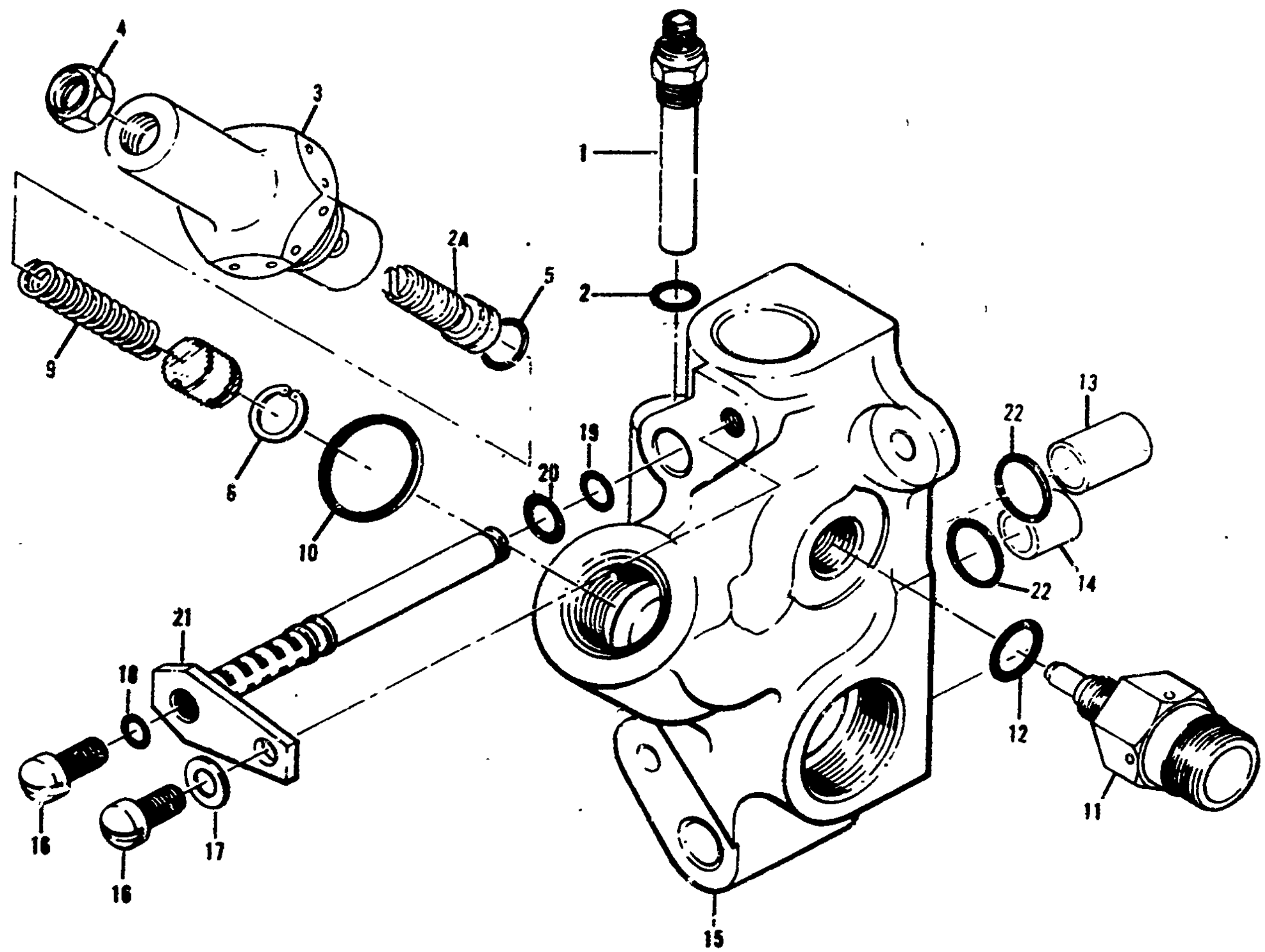
6. Tail rotor hub failures have been quite high and the problem is currently being analyzed with a PIP for a new flex beam assembly which should improve the reliability of the aircraft tail rotor system.

7. The tail rotor and 42° gear box (Tables 7 and 10) have always presented a leakage problem. Studies are currently underway with new types of seals.

8. The hanger assemblies are being examined with the intent of providing a better bearing with longer service life.

9. Comparisons of servocylincers, swashplate, and support assemblies, engine driveshafts and masts are also provided, but little data is available on the other fleets to provide significant comments about problem areas. Major studies are available in each of the individual (MISS) reports.

DISASSEMBLY INSPECTION ANALYSIS

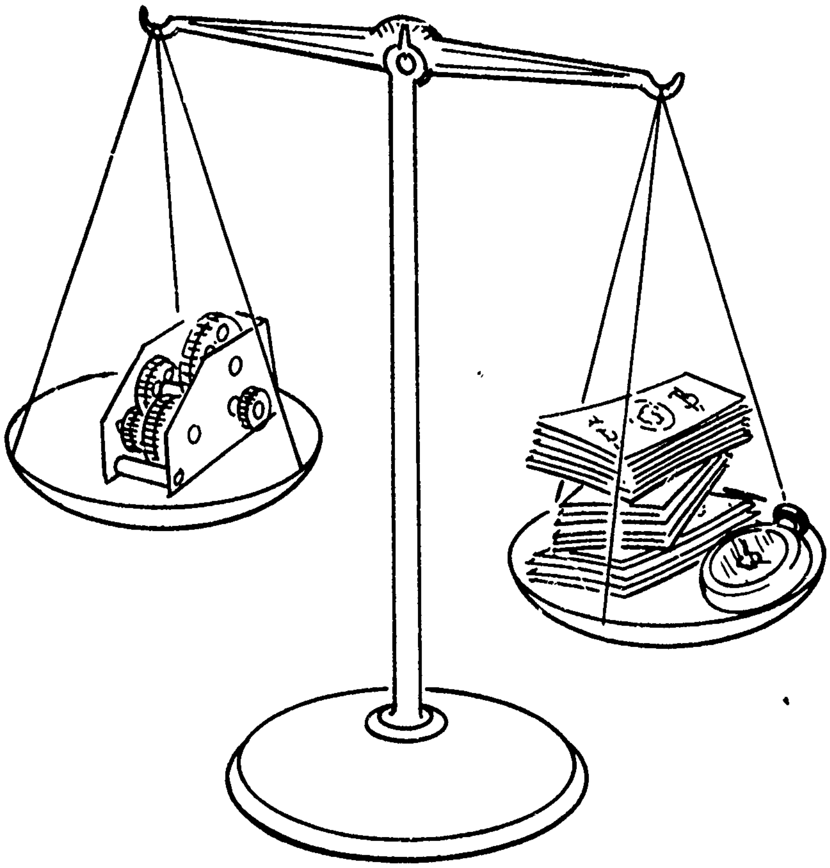


DISASSEMBLY INSPECTION ANALYSIS

A Disassembly Inspection is an examination performed during the disassembly of a component while it is being overhauled. In essence, when the component is brought to the overhaul facility, a brief survey or inspection is conducted on the component while it is being dismantled and any evident mechanical defects are annotated during the process of overhauling the component. The findings of the inspection are then recorded on a Disassembly Inspection Form.

At the present time, there are several different types of inspection reporting techniques. Basically, the inspection should divulge the statistical data, such as aircraft type, model and series, the major assembly, reasons for removal or causes of failure, and the part replacement information.

In the near future the Disassembly Inspection data will be automated. Efforts are being made at this time to evaluate each of the different reporting techniques and determine which system will ultimately fulfill the data analysis requirement. This data will then be consolidated into some standardized form to enable maximum utilization of the Disassembly Inspection information.



CRITICAL ITEMS

CRITICAL ITEMS

The purpose of this chapter is to identify aircraft subsystems/components/parts that appear to be significant with respect to a number of different criteria. Although there presently exists a number of definitions for "Critical Items", they are not meant to be inferred through this chapter. Critical items will be defined here as aircraft subsystems/components/parts for which operational data indicates a possible need for particular emphasis with respect to certain criteria that represent measures of time, safety or money.

For each criterion, critical items are ranked in descending order by associated parameters according to the degree of severity. For example, new item cost per aircraft is a ranking parameter for the cost criterion and the components are arranged from highest cost to lowest cost. On the other hand, mean time between removal is a ranking parameter for the reliability criterion and components are arranged from the lowest time to the highest time. In all cases, the parameter used for ranking is indicated by accenting the applicable column in the table with a heavy border. Also, each table presents the top five critical items for a particular parameter of measure. There is no significance in the number five; it merely represents an arbitrary choice and does not imply an analogy to any other "high-five" indicators.

Following are six tables which rank critical items according to different parameters. Each table includes a detailed description of the rationale behind each table.

CRITICAL ITEMS

TABLE 1

CRITERION: COST

NO.	COMPONENT	NEW COST	NO. PER A/C	TOTAL COST PER A/C
1	Turbine Engine T53-L-13B P/N 1-000-060-10	68,510	1	68,510
2	Transmission Assembly P/N 204-040-016-5	11,620	1	11,620
3	Main Rotor Hub P/N 540-011-101-5	10,643	1	10,643
4	Main Rotor Blade P/N 540-011-250-1	3,408	2	6,816
5	Main Input Quill Assy P/N 205-040-263-3	1,786	1	1,786

NO.	COMPONENT	O/H COST	NO. PER A/C	TOTAL COST PER A/C
1	Turbine Engine T53-L-13B P/N 1-000-060-10	14,871	1	14,871
2	Main Rotor Hub P/N 540-011-101-5	3,051	1	3,051
3	Transmission Assembly P/N 204-040-016-5	2,488	1	2,488
4	Main Rotor Blade P/N 540-011-250-1	580	2	1,160
5	Scissors & Sleeve Assy P/N 209-010-401-11	739	1	739

This table is separated into two sections, one ranking major components by new procurement cost per aircraft and the other ranking major components according to estimated overhaul cost per aircraft. In each case, the number of components per aircraft is multiplied by the component cost in order to obtain a total cost per aircraft.

CRITICAL ITEMS

TABLE 2

CRITERION: EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR'S)

NO.	COMPONENT	NUMBER OF EIRS FOR LAST QUARTER*			
		EMERGENCY	URGENT	ROUTINE	TOTAL EIR'S
1	Servo Cylinder Assy P/N 204-076-005-7	0	4	27	31
2	Swashplate & Support P/N 209-010-400-1	0	1	20	21
3	Turbine Engine P/N 1-000-060-10	0	5	15	20
4	Main Rotor Hub P/N 540-011-101-5	1	0	13	14
5	42° Gear Box P/N 204-040-003-37	1	1	8	10

The five major components having the most EIR's submitted against them during the last quarter of data are presented. The EIR's are classed according to type (i.e., emergency, urgent or routine) but ranked according to totals.

*Quarter ending 1 April 72

CRITICAL ITEMS

TABLE 3

CRITERION: FLIGHT ABORTS

NO.	COMPONENT/SYSTEM	FLIGHT ABORTS PER FLYING HOUR		INCREASE IN FLIGHT ABORTS PER FLYING HR
		12 MO. ENDING 31 MAR 71	12 MO. ENDING 31 MAR 72	
1	Flight Control System	.000038	.000066	.000028
2	Tail Rotor Transmission	.000012	.000028	.000016
3	Electrical System	.000020	.000033	.000013
4	Instruments	.000015	.000024	.000009
5	Hydraulic System	.000212	.000221	.000009

Major components/systems that are suspected causes of flight aborts are presented for the most recent 12 month period and the prior 12 months. Those components/systems that exhibit an increase in the number of flight aborts per flying hour are ranked according to the amount of increase. Flight aborts include all types of mishaps reported by Crash Facts Messages (CFM) such as; precautionary landings, forced landings, incidents, minor accidents, combat damage, major accidents and total losses.

CRITICAL ITEMS

TABLE 4

CRITERION: MAINTAINABILITY

NO.	COMPONENT	MEAN TIME FOR ALL MAINTENANCE ACTIONS	MANHOURS PER FLIGHT HOUR	MANHOURS TO INSTALL
1	Turbine Engine T53-L-13B P/N 1-000-060-10			25.80
2	Transmission Assembly P/N 204-040-016-5			23.11
3	Swashplate & Support P/N 209-010-400-1			8.63
4	Mast Assembly P/N 209-040-366-3			8.54
5	Main Rotor Hub P/N 540-011-101-5			6.72

Three maintainability parameters are presented in this table; Mean Time For All Maintenance Actions (MTAMA), Manhours Per Flight Hour (MH/FH), and Manhours To Install. Presently, the only data available is on Manhours To Install, and, therefore, this is used as the ranking parameter. When the capabilities are developed to obtain MTAMA values, they will be utilized in ranking major components and/or parts.

CRITICAL ITEMS

TABLE 5

CRITERION: RELIABILITY

NO.	COMPONENT	MEAN TIME BETWEEN FAILURE	MEAN TIME BETWEEN REMOVAL
1	Engine Mount, Trunnion P/N 209-060-113-1	214.4	139.1
2	Main Rotor Blade P/N 540-011-250-1	200.0	166.3
3	Tail Rotor Blade P/N 204-011-702-17	186.8	174.3
4	Main Rotor Hub P/N 540-011-101-5	222.4	195.0
5	Tail Rotor Hub P/N 204-011-801-3	232.7	207.5

This table identifies critical items as major components with low measures of reliability as reported by the field. The specific parameters utilized are Mean Time Between Failures (MTBF) and Mean Time Between Removals (MTBR) which is used as the ranking parameter. MTBR values are determined by averaging the operating hours on components since their last removal and includes removals for all reasons. MTBF values are computed similarly except for the fact that only those reasons reported that can be interpreted as actual failures are included.

CRITICAL ITEMS

TABLE 6

CRITERION: CYCLIC OVERHAUL REQUIREMENTS

NO.	PART	PERCENT REQUIRING REPAIR
	No Data Available	

NO.	PART	PERCENT REQUIRING REPLACE
	No Data Available	

The purpose of this table is to identify those parts that require the highest frequency of maintenance actions during cyclic overhaul of aircraft. Cyclic overhaul data is restricted to the parts level and, therefore, major components were excluded. Also, the table is limited to those parts requiring depot level maintenance only since efforts such as Project Extend are aimed at eliminating the problem of lower level maintenance actions being deferred until cyclic overhaul. The table is separated into two sections; one identifying those parts requiring the greatest replacement frequency. The actual value presented for each part is the percent of aircraft from a total sample that required the particular maintenance action on that part.

OBSERVATIONS/DISCUSSION

1. No information was available for Table 6 since cyclic overhaul data has not been reported on the AH-1G aircraft. Action is being taken to insure compliance with the reporting requirement and cyclic overhaul data should be obtainable on the AH-1G in the near future.

2. Since availability is a function of both reliability and maintainability, items which possess both poor reliability and maintainability characteristics deserve particular consideration. The only AH-1G component to appear in the top five with respect to both reliability and maintainability was the Main Rotor Hub. If the Product Improvement Proposal (PIP) for elastomeric flapping axis and feathering axis bearings on the hub is effective, the availability of the hub should be significantly increased and, in turn, that of the AH-1G aircraft.

3. Obviously, component installation time is not the very best measure of maintainability. It is, however, the only parameter currently obtainable from the data system. Manhours per flight hour is a useful and often requested parameter but it is not a pure measure of maintainability since it also depends on reliability. Therefore, computer capabilities are being developed to obtain parameters such as Mean Time To Repair (MTTR) and Mean Time for All Maintenance Actions (MTAMA) which should be more descriptive of the maintainability characteristics of components.

4. Presently, neither the RAMMIT (Reliability and Maintainability Management Improvement Techniques) data system nor the USAAAVS (United States Army Agency for Aviation Safety) data system have automated routines for identifying by part number those components which are suspected causes of flight aborts. Space is provided for this information on crash facts messages (CFM) and the development of automated capabilities might be worth considering.

5. An interesting observation is the fact that for all five components listed in Table 5, the MTFF values are higher than the MTBR values. This indicates that these components are being removed more frequently for reasons other than actual component failures.

6. There appears to be little correlation between recent EIR submittals and components that historically exhibit the poorest reliability characteristics. Again, the Main Rotor Hub was the only component to appear in both tables.

RELIABILITY, AVAILABILITY & MAINTAINABILITY

IMPROVEMENT OF

SELECTED

EQUIPMENT

RELIABILITY, AVAILABILITY, AND MAINTAINABILITY (RAM) IMPROVEMENT OF SELECTED EQUIPMENT

The concept of a RISE program was initiated in September 1969 as the result of the Commanding General, US Army Materiel Command (AMC) placing significant emphasis on reliable and maintainable Army equipment. RISE is currently one of the seven requirements for reporting RAM assessment objectives placed on the major subordinate commands by AMC. Increased emphasis in this area is evident in AMC Regulation 702-15, Reliability, Availability, and Maintainability Improvement of Selected Equipment (RISE), released in April 1972.

The AVSCOM RISE program is currently being revised and expanded in accordance with the guidance provided by AMC in the recently released AMC Regulation 702-15. The following chapter presents the information currently available. It is planned that the status of the RISE program will be reported on a regular basis in the Management Summary Report.

The RISE program objective is simply the improvement of RAM for operational systems to reduce maintenance support costs. The RISE program has been structured to include four phases:

Phase I - Identification.

Phase II - Analysis.

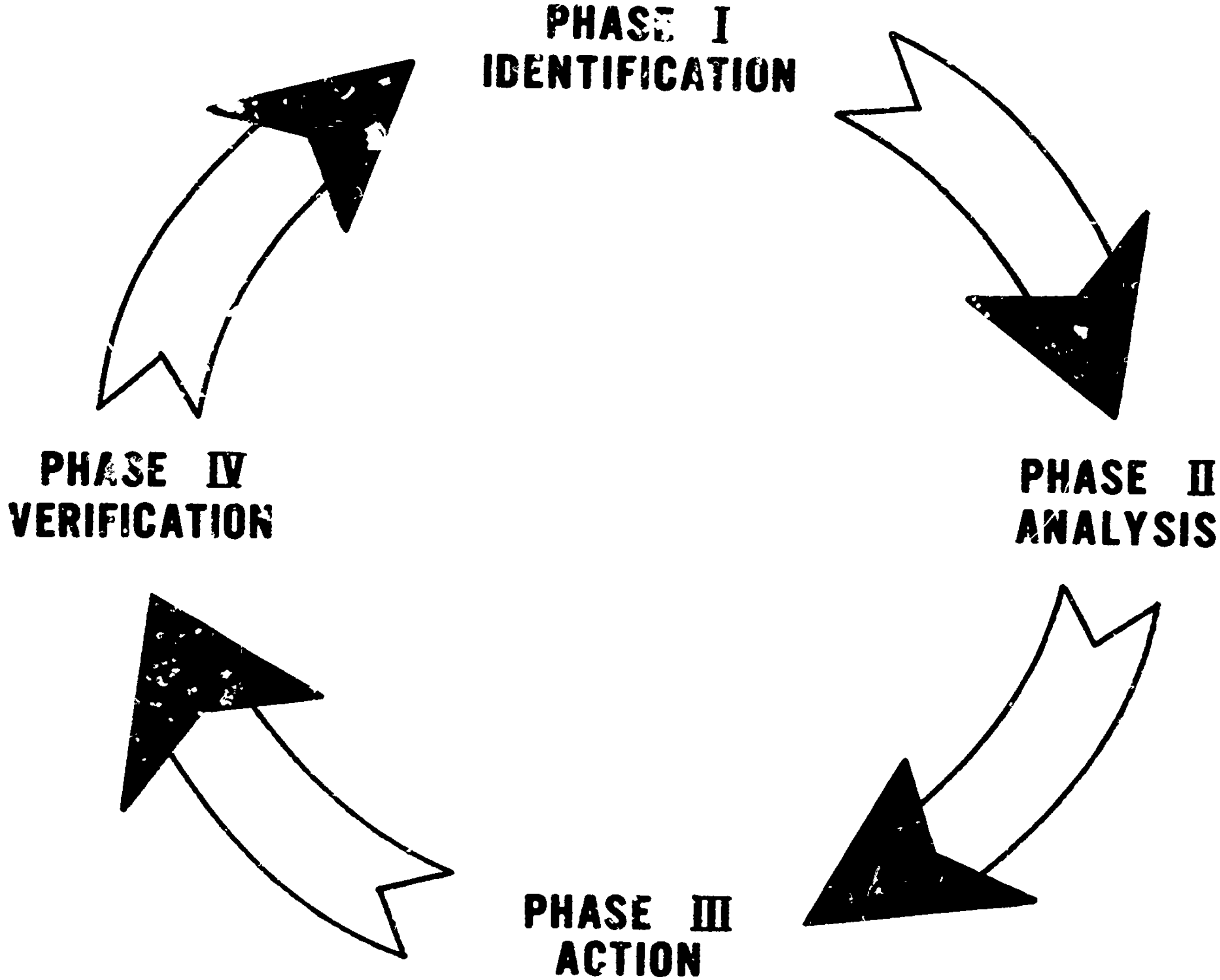
Phase III - Action.

Phase IV - Verification.

Illustration 1 attempts to portray the operation of the RISE program as a process, indicating that it is a continuous effort. The identification

ILLUSTRATION 1

THE RISE PROGRAM



phase requires that potential candidates for RAM improvement be identified through the accomplishment of systems performance analysis on operational systems/subsystems/components. The analysis phase involves engineering and cost analysis being performed to select alternative design approaches for RAM improvement. A decision risk analysis should be conducted if viable alternatives surface. The action phase requires that management take the necessary actions to approve and implement projects for RAM improvement when such projects will result in net life-cycle cost savings through a reduction in requirements for maintenance support. The verification phase involves assessment of improved equipment with respect to RAM performance and cost of maintenance support to determine what degree of improvement was actually achieved.

RISE

PHASE III - ACTION

The following tables present RISE candidates that have evolved from the AVSCOM FY 74 Product Improvement Proposal (PIP) program. These candidates can be considered as having been through the identification and analysis phases and now being in the action phase of the process. The pertinent aspects of each proposal are presented in the tables. The individual PIPs should be consulted for more detailed information.

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORMANCE	EST. SAVINGS ($ MIL)
1-74-01-102	APP	UH-1 Servo Cylinder	335 Hrs MTBR	1200 Hrs MTBR	Improved Scraper Rings and Seals and Elimination of Motoring Problem.	74	PEMA	.315	1.272	Improved Maintainability	3.717
							O&MA	.006			
						75	PEMA	.315			
							O&MA	.006			
						76	PEMA	.315			
						77	PEMA	.315			
1-74-01-109	APP	UH-1 C/M Main Rotor Hub	313 Hrs MTBR	2500 Hrs MTBR	Elastomeric Trunnion and Feathering Axis Bearings.	74	PEMA	.845	7.301	Improved Maintainability	16.331
							O&MA	.009			
						75	PEMA	1.931			
							O&MA	.009			
						76	PEMA	2.146			
						77	PEMA	2.361			
1-74-01-112	APP	UH-1 D/H Main Rotor Hub	525 Hrs MTBR	2500 Hrs MTBR	Elimination of Oil Leakage Using Elastomeric Bearings.	74	PEMA	1.622	9.284	Increased Availability	5.613
							O&MA	.009			
							PEMA	2.548			
							O&MA	.009			
							PEMA	2.548			
							PEMA	2.548			

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATE' PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORMANCE	EST SAVINGS ($ MIL)
1-74-01-114	APP	UH-1 D/H Tail Rotor Assembly	415 Hrs MTBR	900 Hrs MTBR	Extension of Tail Rotor Service Life Utilizing Flex Beam Assembly.	74	PEMA	1.439	8.570	Safety	20.534
							O&MA	.006			
						75	PEMA	2.373			
							O&MA	.006			
						76	PEMA	2.373			
						77	PEMA	2.373			
1-72-1-018C	APP	AH-1G Main Transmission	UNK	UNK	Strengthened Lugs on Transmission Main Support Case Assembly	74	PEMA	.010	1.446	Increased Availability	UNK
							O&MA	.568			
						75	PEMA	.230			
							O&MA	.002			
						76	PEMA	.449			
						77	PEMA	.187			
1-73-01-403E	APP	AH-1G Main Rotor Hub	500 Hrs life	2500 Hrs life	Incorporation of Elastomeric Flapping Axis Bearings.	73	PEMA	.504	.553	Reduced Maintenance Time	8.914
							O&MA	.003			
						74	PEMA	.021			
						75	PEMA	.025			
1-73-01-402E	APP	AH-1G Circuit Breaker Panel	6 month life	12 month life	Installation of Toggle-Type Circuit Breakers	74	PEMA	.068	.095	Safety	.160
							O&MA	.022			
						75	O&MA	.005			

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL					
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORM-ANCE	EST SAVINGS ($ MIL)
1-73-01-404B	APP	AH-1G Main Rotor Hub	300 Hrs life	2500 Hrs life	Incorporation of Elastomeric Feathering Axis Bearings.	74 75 76 77	PEMA O&MA PEMA O&MA PEMA PEMA	.080 1.677 3.600 .762 4.358 .045	10.522	Reduced Mainte-nance Time	81.817
1-73-01-407B	APP	AH-1G Tail Rotor Assembly	1100 Hrs Fatigue Life	2200 Hrs Fatigue Life	Flex Beam Tail Rotor Assembly	73 74 75	PEMA O&MA PEMA O&MA PEMA	2.115 .013 .126 .001 .135	2.390	Safety	UNK
1-73-01-414B	APP	AH-1G Avionics System	UNK	UNK	Tailboom Avionics Cooling	74 75	PEMA O&MA PEMA O&MA	.030 .033 .021 .020	.104	Safety	UNK

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORM-ANCE	EST. SAVINGS ($ MIL)
1-73-01-215A	APP	CH-54 A/B Cargo Hoist Decoupler Assembly	329 Hr MTBF	5000 Hr MTBF	Elimination of Leakage and/or End Cap Rupture With Installation of Elastomeric Spring Design Decoupler.	74 75 76 	O&MA PEMA O&MA S.F. O&MA	.095 .188 .007 .062 .005	.357	Safety Maintain-ability System Accuracy	UNK
1-73-01-225A	Funded FY 73	CH-54 A/B Power Plant Controls	175 Hr MTBF	1500 Hr MTBF	Provision of Separate Mounting Brackets for Collective Bias, N1 and N2 Controls.	73 74 76 	PEMA O&MA PEMA O&MA S.F. O&MA	.027 .020 .022 .058 .008 .048	.183	Reduced Mainte-nance Require-ments	.104
1-73-01-226A	APP	CH-54 A/B Fuel Tank Boost Pump Pressure Switch	345 Hr MTBF	2000 Hr MTBF	Installation of Pres-sure Switch Which is Less Susceptible to Fuel Contamination Failure	73 74 	O&MA PEMA S.F. O&MA	.005 .038 .008 .028	.079	Increased Avail-ability	UNK
1-73-01-231A	AFP	CH-54A Cargo Hoist Pump Assembly	776 Hr MTBF	4000 Hr MTBF	Installation of Improved Microswitch and Added Sealing Provisions.	73 74 75 76 	O&MA PEMA O&MA PEMA S.F. PEMA S.F.	.005 .025 .001 .003 .002 .002 .002	.040	Increased Avail-ability	UNK

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORM-ANCE	EST. SAVINGS ($ MIL)
1-74-01-204	APP	CH-54A Engine Support Installation	UNK	UNK	Replacement of the Present CH-54A Engine Mounts With CH-54B Fore and Aft Engine Mounts and the Redundant "H" Flange Spring Mounts.	72	O&MA	.040	2.235	Safety	UNK
						74	PEMA	1.615			
							O&MA	.017			
						75	PEMA	.200			
							S.F.	.217			
						76	PEMA	.023			
							S.F.	.050			
						77	PEMA	.023			
							S.F.	.050			
1-73-01-217A	APP	CH-54 A/B Main Gear Box Pressure Switch	840 Hr MTBF	2000 Hr MTBF	Elimination of Pressure Switch Failures Caused by Vibration	70	PEMA	.011	.040	Safety	UNK
						74	PEMA	.012			
							O&MA	.013			
						75	S.F.	.001			
							O&MA	.003			
1-74-01-212	APP	CH-54 A/B Rotor Brake Package Assembly	181 Hr MTBF	2000 Hr MTBF	Relocation of Rotor Brake Assembly from High Vibration Location.	70	PEMA	.007	.052	Increased Avail-ability	.446
						74	PEMA	.008			
							O&MA	.028			
						75	S.F.	.002			
							O&MA	.002			
						76	S.F.	.003			
							O&MA	.002			

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORM-ANCE	EST. SAVINGS ($ MIL)
1-74-01-206	APP	CH-54 A/B APP Start Motor Assy.	36.5 Hr MTBF	2000 Hr MTBF	Installation of Flow Regulator and Low Cracking Check Valve.	72	O&MA	.019	.068	Increased Avail-ability	.421
						74	PEMA	.014			
							O&MA	.028			
						75	S.F.	.002			
							O&MA	.005			
1-74-01-207	Defer-red	CH-54 Main Rotor Hub	1500 Hr TBO	2000 Hr TBO	Addition of Bonded Anti-Chafing Shims on M/R Control Horn.	70	PEMA	.010	.175	Increased Avail-ability	UNK
						74	PEMA	.029			
							O&MA	.017			
						75	PEMA	.039			
							S.F.	.005			
						76	PEMA	.039			
							S.F.	.010			
						77	PEMA	.026			
1-74-01-208	Defer-red	CH-54B Main Gear Box Assembly	900 Hr TBO	1500 Hr TBO	Modified Primary Servo Attachment Brackets.	70	PEMA	.024	.111	Increased Avail-ability	UNK
						74	PEMA	.024			
							O&MA	.017			
						75	PEMA	.014			
							S.F.	.002			
						76	PEMA	.014			
							S.F.	.002			
						77	PEMA	.013			
							S.F.	.001			

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORM-ANCE	EST. SAVINGS ($MIL)
1-74-01-209	APP	CH-54 A/B Tail Rotor Blade Assembly	1600 Hr (B) 2500 Hr (A) Retire-ment Life	"On Condition"	Modified Cuff/Spar Attachment Bolt Holes.	73	PEMA	.032	.990	Increased Avail-ability	.422
						74	PEMA	.100			
							O&MA	.017			
						75	PEMA	.274			
						76	PEMA	.274			
							S.F.	.010			
						77	PEMA	.273			
							S.F.	.010			
1-74-01-211	APP	CH-54B Main Rotor Brake Disc	288 Hr MTBF	1500 Hr MTBF	Prevention of Rotor Brake Disc Fracture and Excessive Main Gear Box Carbon Seal Leakage.	74	PEMA	.008	.048	Safety	UNK
							S.F.	.010			
							O&MA	.025			
						75	S.F.	.003			
							O&MA	.002			
1-74-01-213	APP	CH-54 A/B Rotor Blade Assembly	200 Hr MTBF	2000 Hr MTBF	Elimination of Crack-ing Failures of the Assembly Root Fairing.	74	PEMA	.043	.121	Safety	2.600
							O&MA	.015			
						75	S.F.	.002			
							O&MA	.016			
						76	S.F.	.004			
							O&MA	.016			

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORMANCE	EST. SAVINGS ($ MIL)
1-74-01-214	APP	CH-54 A/B Tail Rotor Drive Shaft Support Assy.	240 Hr MTBF	2500 Hr MTBF	Improved Design Bearing Supports.	70 74 75 	PEMA PEMA S.F. O&MA S.F. O&MA	.011 .090 .005 .025 .015 .026	.172	Increased Availability	.780
1-72-1-009B	APP	Anti-Icing Valve, CH-47	4800 Manhours/ Year	UNK	Elimination of Gasket, Screw, Relief Valve, and Vibration Failures.	74 75	PEMA PEMA	.060 .011	.071	Safety	UNK
1-73-01-208A	APP	CH-47 A/B/C Engine Mount System	400 Hr MTBF (Housing)	Infinite MTBF	Elimination of Engine Inlet Housing Cracks and Improved Mounts.	73 74 	PEMA PEMA S.F. O&MA	.150 .512 .140 .044	.846	Increased Availability	UNK
1-73-01-243A	APP	CH-47 A/B/C Rotary Wing Blades	UNK	UNK	Integral Spar Inspection System (ISIS).	73 74 75 76 	PEMA S.F. O&MA PEMA S.F. PEMA S.F. PEMA S.F.	.910 .030 .010 1.440 .150 1.440 .050 .360 .050	4.440	Safety	22.325

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORM-ANCE	EST. SAVINGS ($ MIL)
1-74-01-223	APP	CH-47 A/B/C Engine Drive Shaft	1000 Hr MTBF	UNK	Improved Drive Shaft Splines.	74	PEMA	.025	.215	Increased Avail-ability	UNK
							O&MA	.110			
						75	PEMA	.030			
						76	PEMA	.025			
						77	PEMA	.025			
1-74-01-227	APP	CH-47 A/B/C Oil Pressure Transducer	UNK	UNK	Vibration Tolerant and Economically Repairable Component Parts.	74	PEMA	.105	.675	Increased Avail-ability	UNK
							O&MA	.030			
						75	PEMA	.210			
							O&MA	.002			
						76	PEMA	.210			
							O&MA	.005			
						77	PEMA	.105			
							O&MA	.005			
						78	O&MA	.003			
1-74-01-228	APP	CH-47C Torque Meter Power Supply	UNK	UNK	Testing Evaluation and Redesign	74	PEMA	.037	.328	Safety	UNK
							O&MA	.254			
						75	PEMA	.037			

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORM-ANCE	EST. SAVINGS ($ MIL)
1-73-01-C10A	Defer-red	OH-58A Mast Assembly Bearings	450 Hr MTBF	900 Hr MTBF	Improve Bearing and Housing.	74 75 76 77	PEMA O&MA PEMA O&MA O&MA O&MA	.186 009 .199 .057 .057 .015	.523	Safcty	7.308
1-73-01-011A	Defer-red	OH-58A Tail Rotor Hub Assembly	6 Manhour Adjust-ment	0 Manhour Adjust-ment,	Application of Elastomeric Bearings.	74 75 76 77	PEMA O&MA PEMA PEMA PEMA	.088 .010 .088 .079 .009	.362	Improved Relia-bility	.172
1-73-01-012A	Defer-red	OH-58A Gear Box Tail Rotor	426 Hr MTBR	2400 Hr MTBR	Reduction of Surface Fatigue and Spalling of Pinion and Spiral Bevel Gears.	74 75 76 77 78	O&MA O&MA PEMA PEMA PEMA	.110 .054 .035 .035 .087	.321	Safety	.234

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSALS (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORMANCE	EST. SAVINGS ($ MIL)
1-73-01-018A	APP	TH-55A Engine Mount Hangers	UNK	UNK	Elimination of Cracking Failures.	72 74	O&MA PEMA	.015 .031	.046	Increased Availability	UNK
1-74-01-016	Deferred	OH-58A Main Rotor Hub	598 Hrs MTBR	707 Hrs MTBR	Application of Elastomeric Bearings for Pitch Change and Flapping Axis.	74 75 76	PEMA O&MA PEMA PEMA	.444 .020 1.728 1.752	3.944	Reduced Maintenance	UNK
1-74-01-501	APP	RU-21 Access Cover and Electrical System	150 Manhours	1 Manhour	Lower Fuselage Access Covers and Installation of External Power Relay.	74 75	PEMA O&MA PEMA O&MA	.025 .002 .001 .002	.030	Increased Availability	.697
1-72-01-507	APP	RU-21 Inverter Access	4 Manhours	1 Manhour	Enlargement of Inverter Access Opening.	74 75 76	PEMA PEMA O&MA O&MA	.005 .102 .036 .039	.182	Increased Availability	.050 (Annual)

RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM)
RELATED PRODUCT IMPROVEMENT PROPOSAL (PIP)

PIP NUMBER	STATUS	END ITEM AND COMPONENT	QUANTITATIVE RAM IMPROVEMENT		DESCRIPTION OF IMPROVEMENT	FUNDING LEVEL				RELATED BENEFITS	
			CURRENT	PREDICTED		FY	TYPE	COST ($ MIL)	TOTAL ($ MIL)	PERFORMANCE	EST. SAVINGS ($ MIL)
1-72-01-701-B	APP	CH-54 A/B T73 Engine	315 Replacements per year	63 Replacements per year	N2 Sense Cable Replacement.	74 75	PEMA S.F. O&MA PEMA S.F.	.111 .015 .006 .073 .012	.217	Safety	.078 (Annual)
1-73-01-230A	APP	CH-54 & CH-47 T62 APU	UNK	UNK	Improved Fuel Pump, Oil Pressure Switch and Speed Switch.	74 75 76 77	O&MA PEMA PEMA PEMA	.040 .258 .252 .189	.739	Mission Reliability	UNK
1-74-01-707	APP	CH-47 T-55-L-7C Engine	25% Rejection Rate	1% Rejection Rate	Elimination of Fuel Pump Spline Wear.	74 75 76 77	PEMA PEMA PEMA PEMA	.062 .180 .217 .194	.653	Safety	.010 (Annual)

OBSERVATIONS/RECOMMENDATIONS/DISCUSSION

1. A recent review of the AVSCOM FY 74 Product Improvement Proposal (PIP) program included 117 PIPs. Of these, 27 were categorized as safety related, 50 as performance related and 40 as RAM related. Therefore, 34% of the FY 74 PIP submittals were proposals addressing reliability and maintainability problem areas.

2. A noteworthy observation is the advent of elastomeric technology. The FY 74 PIP program included proposals for elastomeric feathering and flapping axis bearings on the main rotor hubs for the UH-1H, AH-1, and OH-58 aircraft. Also included was a proposal for application of elastomeric bearings to the OH-58 tail rotor hub and a proposal for a CH-54 cargo hoist decoupler assembly utilizing an elastomeric spring design.

3. AR 700-35, Product Improvement of Materiel, directs that all PIPs, except where safety is the reason for the product improvement, must be evaluated with an economic analysis to be conducted in accordance with AR 37-13, Economic Analysis of Proposed Army Investments. Of the 40 RAM related PIPs reviewed, 19, or almost one half, did not have cost studies performed on them at the time of this review. It is recommended that the responsible offices take the necessary actions to insure that all PIPs have a cost analysis performed on them when required.

4. AR 700-35 also indicates that reliability and maintainability proposals should be described in quantitative terms. This is not always done and sometimes not accomplished in the very best way. For example, Mean Time Between Failure (MTBF) is a much better measure of reliability than Time Between Overhaul (TBO) because TBO is an arbitrary value that is not necessarily a function of reliability. Also, parameters such as

manhours/year are questionable since they are dependent upon the actual usage of the item; a much better measure of maintainability would be Mean Time to Repair (MTTR) or Mean-Maintenance-Time.

5. Instructions in AR 700-35 for preparing DA Form 3701-R, Product Improvement Proposal, directs that the type of improvement should be indicated in Block 15. Occasionally, there seems to be some misunderstanding when it comes to classifying reliability or maintainability type proposals. Proposals that are exclusively either reliability improvements or maintainability improvements are sometimes presented as reliability <u>and</u> maintainability improvements. It should be noted that a reliability improvement does not necessarily imply a maintainability improvement and vice versa. Also, improvements that are strictly reliability type are sometimes classified as maintainability improvements, the logic being that, since they extend life (or time between maintenance actions), this constitutes a maintainability improvement. It should be realized that reliability is associated with frequency of maintenance actions while maintainability is associated with duration of maintenance actions. It is recommended that MIL-STD-721B, Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety, be consulted for accepted definitions of reliability and maintainability.

6. Although PIPs constitute a major portion of the RISE program, other efforts are also involved. These other inputs were not available at publication time, but will be included in the future as they become available.

7. All organizations participating in the RAM improvement of Army aviation equipment are requested to contact this Command, Directorate for Product Assurance, Systems Performance Assessment Division, Independent Assessment Branch (AMSAV-LSI) if their efforts are not presently

being acknowledged as part of the AVSCOM RISE program.

8. The implementing instructions for AMCR 702-15, Reliability, Availability, and Maintainability Improvement of Selected Equipment (RISE), are being developed by AMSAV-LSI in the form of an AVSCOM regulation and will be coordinated and released in the near future. All recommendations and/or comments directed toward developing a sound beneficial Command program for RAM improvements are openly solicited.

APPENDIX A

This Appendix presents background information on the operational aspects of the overall EIR system. This is to aid in a more thorough understanding of the steps being taken within this Command to attain maximum utilization of EIR's and at the same time reduce any administrative burdens associated with this system. Two informational sections are presented; the first describes both the procedure of assigning case numbers to EIR's and also the validation process of correcting case numbers which are not compatible with existing automated techniques. The second section briefly describes an automated system developed specifically to reduce the administrative burden and cost of processing routine EIR's received at this Command.

ASSIGNMENT OF EIR CASE NUMBERS

When an EIR is received at AVSCOM, an engineer assigns it to an EIR case according to predesignated codes. These codes when grouped together determine a case number as follows:

XX XX XXX XX -----X

Part number of failed component/assembly

Failure Code

Functional Group Code

Action Office Designation Code

The most significant portion of this case number is the part number: This is because the part number must be correct in order for it to be matched against a master file which is arranged in -34P parts manual sequence. This matching process aligns and groups the data (cases) into a comprehensive format which is adaptable for future analysis. This matching process is fully automated.

If the EIR Case Part Number cannot be matched with the -34P master file, the EIR is rejected from analysis. The EIR's which are not assigned to cases are not considered for analysis. In the past a massive effort was expended in correcting those cases where the part number did not match the -34P master file. Steps have been taken to monitor the incoming EIR's being assigned cases so that a massive updating effort will not be required in the future. Corrections consist mainly of adding the proper dash number to the part number or changing keypunch errors.

AUTOMATED EIR REPLY SYSTEM

This system was developed to relieve the Aircraft Project Offices of the administrative workload of answering recurring type routine EIR's. It has been conservatively estimated that 20-30% of all routine EIR's received at the Command on a yearly basis can be answered through a computerized type reply letter. (See letter on adjacent page). By utilizing this automated system, engineers can devote a higher proportion of time to more complex problems related to Emergency/Urgent EIR's. An initial cost study has revealed that $50,000 - $60,000/yr are being saved by implementing this system. Another advantage of this system is that it provides the additional resources necessary to handle all incoming EIR's and also reduce current backlogs.

DEPARTMENT OF THE ARMY
US ARMY AVIATION SYSTEMS COMMAND
PO BOX 209, ST. LOUIS, MO 63166

JAN 10 1971

AMSAV-R-EU

REPLY TO EIR W28303 WHICH WAS RECEIVED AT AVSCOM 19 MAR 1970

COMMANDING OFFICER
117TH AVIATION CO.
APO SAN FRANCISCO 96266

SUBJECT EIR REPLY

1. YOUR RECOMMENDATION WHICH WAS SUBMITTED ON EIR W28303 WAS REVIEWED BY THE APPLICABLE TECHNICAL STAFF AT AVSCOM AND WAS ENTERED INTO EIR CASE NUMBER PO-03-032-204-060-541-3.

2. UPON RECEIPT OF YOUR EIR, DATA RECORDED ON THE EIR WAS ENTERED INTO A STATISTICAL FILE WHICH IS USED BY TECHNICAL ANALYSTS FOR THE PURPOSE OF IMPROVING THE PRESENT SYSTEMS AND IN THE DESIGN OF FUTURE SYSTEMS. THESE STATISTICS ARE REPORTED IN THE AVSCOM EIR QUARTERLY RECORD WHICH IS ISSUED EACH QUARTER TO MAJOR COMMANDS AND RESPONSIBLE ORGANIZATIONS FOR EQUIPMENT IMPROVEMENTS.

3. THE AVSCOM TECHNICAL STAFF THAT REVIEWED EIR W28303 MADE THE EVALUATIONS DESCRIBED BELOW.

A. IN REVIEWING YOUR EIRS, ALL PERTINENT DATA WAS EXTRACTED BY THIS OFFICE AND RECORDED FOR STATISTICAL PURPOSES.

B. ACTION TAKEN BY YOUR UNIT WAS CORRECT, HOWEVER THE DEFECTIVE ITEM IS NOT REQUIRED AS AN EXHIBIT AND SHOULD BE DISPOSED OF IN ACCORDANCE WITH CURRENT SUPPLY DIRECTIVES.

C. SINCE NO FAILURE TREND HAS BEEN IDENTIFIED BY US AT THIS TIME, THIS CASE IS CLOSED.

CHIEF, UH-1 DIV, SYS ENGR DIR

PAGE 1 OF 1

APPENDIX B

APPENDIX B

DESCRIPTION OF RAMMIT REPORTS

This particular appendix is designed to display data available through other RAMMIT reports. Due to the interrelationships among these various reports, the data and analyses found in one report may be presented in much greater detail in another report. In many cases, other reports must be consulted to determine influencing factors or to obtain related data elements. Therefore, due to these relationships among the various reports, a person utilizing any of the reports should also have an understanding of what information is available in other outputs. To supply this basic understanding, the following paragraphs briefly describe the basic RAMMIT reports which are available or will soon be available and the contents of each. In addition, a table is provided to summarize the type of report, its operational status and its availability at the fleet level.

VALIDATION REPORTS

The purpose of the validation report is to identify, measure, and display information pertaining to the quality and quantity of TAERS reporting. These reports are prepared and submitted quarterly for each TMS fleet and contain detailed analyses presented in such a manner that the reporting records of the various Army Areas, Commands, Owning Organizations, and Individual Aircraft can be compared and evaluated. Having the information in this format permits all levels in the Army Maintenance Structure to analyze and control the quality of TAERS reporting from the organizations under their cognizance.

ACTIVITY REPORTS

Each quarter (most recent three month calendar period) an activity report is generated for each TMS fleet at each maintenance echelon. For each TMS fleet, individual reports will be generated for organizational level maintenance activity, direct support level maintenance activity, general support level maintenance activity, and depot level maintenance activity (cyclic overhaul) on end item aircraft.

The activity report for each echelon presents totals and averages pertaining to accrued flight hours, quantities and types of maintenance actions, maintenance manhours, and out of service time related to maintenance performed during each of the most recent past eight quarterly reporting periods.

The aircraft which received the maintenance during each quarter are grouped in several different ways in various sections of the reports so that the maintenance parameters can be displayed for the whole TMS fleet; for each repairing organization; for the aircraft of each contractual production year; and for the aircraft in each Army Area, Command, and Owning Organization. Further, applicable parameters are presented for each serial-numbered aircraft which received maintenance during the most recent reporting period.

MANHOUR REPORTS

Each quarter a report is published for each TMS fleet which displays the maintenance manhours expended during the past two years and during the most recent quarter at each of the four maintenance echelons. The presentations are such that comparisons can be made between Army Areas, Commands, Repairing Organizations, Owning Organizations, Contractual Production Years, and Individual Aircraft.

The manhour values presented in the Activity Reports are analyzed in greater detail in these reports by displaying the average manhours required to accomplish each type of Maintenance Action, Maintenance Manhours per flight hour, and scheduled and unscheduled manhours associated with each part, component, installation, assembly, and functional group included in the applicable -35P parts manual. Due to the volume of data, the above parameters are presented at the functional group and end item aircraft levels only for Army Areas, Commands, Organizations, Contractual Production Years, and Individual Aircraft.

MAINTENANCE ACTION REPORTS

Each quarter a report is published for each TMS fleet which displays the quantities, frequency, causes (failure mode), and corrective actions associated with the maintenance expended on each part, component, assembly, installation, and functional group included in the applicable -35P parts manual. The presentations are such that comparisons can be made between Army Areas, Commands, Repairing Organizations, Owning Organizations, Contractual Production Years, and Individual Aircraft. However, as with the manhour reports, information below the functional group level is presented only at the fleet level.

TMS FLEET M&R SUMMARY REPORTS

An M&R Summary Report is generated for each TMS fleet for each quarterly reporting period. This report, for each TMS fleet, will be composed of selected extract sections for each of the Activity, Manhours, Maintenance action, and Validation Reports. Therefore, each TMS M&R Summary Report will contain maintenance-significant information concerning each Maintenance Echelon. Since the above categories of reports are presented at each echelon in detail, the contents of each must be summarized for the M&R Report. With this accomplished, management and engineering can take a look at the overall maintenance situation for each particular TMS fleet. If the information included in the M&R Summary indicates the existence of certain problems, then the Activity, Manhour, or Maintenance Action Reports can be consulted for the necessary substantiating detail. Presentations are such that comparisons can be made among Army Areas, Commands, Organizations, Contractual Production Years, and Repairing Organizations.

AVSCOM M&R SUMMARY

Each of the TMS fleet M&R Summary Reports discussed above are concerned with only one TMS fleet of aircraft. The AVSCOM M&R Summary Report contains the same basic information on all TMS fleets of aircraft. This report will provide an overall look at the aircraft maintenance situation and will allow for various comparisons among the fleets. If a particular fleet appears to be experiencing excessive maintenance requirements, then the TMS fleet M&R Summary Report for that particular fleet can be consulted for greater detail. For further detailed information, the various other reports for the TMS fleet can be consulted.

QUARTERLY RECORD OF DEPOT-LEVEL MAINTENANCE

This type of report is comprised primarily of a well-organized computer printout of reported maintenance and manhour expenditures on individual aircraft processed through depots and depot level activities for cyclic overhaul. Also included in the report are an index of applicable aircraft serial numbers and descriptions of all data elements included. This type of report establishes a record of exactly what maintenance was performed on each aircraft and can be used in some cases to: compare the maintenance performed at various depots; determine the effectiveness of lower echelons of maintenance; study the cost effectiveness of Army versus contractor-operated depots; and to investigate field complaints concerning aircraft returned from depot overhaul.

The Cyclic Overhaul Record can be used in conjunction with the Cyclic Overhaul Activity, Manhours and Maintenance Action, and Life Cycle Analyses Reports to evaluate the Cyclic Overhaul Program.

COMBAT DAMAGE AND CRASH DAMAGE REPORTS

Separate Manhour, Activity, Maintenance Action, and Quarterly Record of Depot Level Maintenance Reports are available on demand for Combat and/or Crash Damage Maintenance Expenditures for each TMS fleet at the depot level. These types of information can be used to determine components which need to be improved to withstand hard landings, components which should be protected by armor plate or redundancy, and failures which would be prevented by automatic shutoff or fuzing.

QUARTERLY RECORD OF EQUIPMENT IMPROVEMENT RECOMMENDATIONS

This is a quarterly report for each TMS fleet. Its primary purpose is to show the summation of Equipment Improvement Recommendations (EIRS) on each TMS fleet. The data will be tabulated according to the -35P manuals to show which items, assemblies, and functional groups are the subjects of the EIR reporting. The appendix of each TMS EIR Report lists and answers certain questions which are designed to point out trends in the reporting.

ACTION - AIRCRAFT COMPONENT TIME SINCE INSTALLATION, OVERHAUL, OR NEW

This report is initiated by request for selected time change, finite life, or condition components which are included in the DA Form 2410 reporting system. Included in the report for a specific FSN and part-numbered component is a display of average time to removal for each and all failure codes. Further, the average time to removal for each failure code is presented for components which have had zero prior overhauls, one prior overhaul, and two or more prior overhauls. Therefore, each report displays the average time to removal, causes of removal, and the effects of overhauls on average times to removal and reasons for removal.

CASIR - CHRONOLOGICAL ANALYSIS OF SELECTED ITEMS RECORD

This report is initiated by request for selected serial-numbered finite life, time change, or condition items included in the DA Form 2410 reporting system. The purpose of the report is to develop the maintenance history of each of the selected serial-numbered components. This includes the individual aircraft on which the components have been installed and the removal and overhaul history of each component. Thus, the maintenance history and Army Organizations responsible for this history are displayed. This information is displayed in a paragraph format which can be read and understood without the use of codes or special knowledge of the TAERS 2410 system or reporting form.

TASIR - THE AIRCRAFT SELECTED ITEMS RECORD

This report is initiated by request for information pertaining to installations and removals of "All or Selected" time change, finite life, or condition components on one serial-numbered aircraft. The selected components must be those included in the DA Form 2410 reporting system. Thus, a TASIR for a given serial-numbered aircraft consists of a chronological history of removals and installations of selected types of components (transmissions, gearboxes, rotor blades, etc.). Each record in the chronological listing is presented in a paragraph format which can be read and understood without the use of codes or special knowledge of the TAERS 2410 system or reporting form.

TALCMOR - THE AIRCRAFT LIFE CYCLE MAINTENANCE AND OWNERSHIP RECORD

A chronological listing, starting with the acceptance of an aircraft into the Army Inventory, comprised of all maintenance actions performed on the aircraft, transfers of ownership, and scrappage or salvage actions which occur during the life cycle of the aircraft, was developed to provide a historical record of maintenance and ownership for each aircraft in the Army Inventory. The arrangement of data in this listing, termed "The Aircraft Life Cycle Maintenance and Ownership Record" (TALCMOR), facilitates the application of validation procedures and allows numerous other analyses to be performed; such as, reconstruction of lost records, establishment of failure trends, detection of design deficiencies, etc. This listing is available for each serial-numbered aircraft on request. Although the original TALCMOR reports included much coded information, the current TALCMOR format is easily read and understood. This has been accomplished by rearranging and labeling the various data elements and by the inclusion of descriptions for coded information.

LIFE CYCLE ANALYSES

These analyses are designed to determine the relationship between accrued component or aircraft operating time and maintenance requirements. The outputs will provide various maintenance-significant parameters to determine: Life Cycle Costs; Optimum Cyclic Overhaul Interval; Maintenance Requirements as a function of aircraft operating age at each and all echelons, various locations, and under various operating environments; and optimum maintenance policies. As time permits, analyses concerning manhour expenditures and frequency of maintenance will be performed for each TMS fleet.

CRASH FACTS REPORT

Pertinent information concerning aircraft crashes will be published monthly or on demand by TMS fleet. The information included relates to the degree of damage, causes of the accident, and components or systems suspected as being contributing factors.

GLIM - GAINS AND LOSSES IN THE INVENTORIES OF MAJOR ITEMS

Gains and Losses in the Inventory of Major Items (GLIM) is one of a series of reports drawn from DA Form 2410 as a part of the RAMMIT system of reports. Only reportable items, those time change and selected reportable components listed in TB 55-1500-307-25, are contained in this listing.

The organization of this report is such that the gains and losses in inventory can be determined from the standpoint of the type of maintenance action that caused the gain or loss, as well as the unit responsible for the action. The individual items are listed by serial number and a general picture is given with an overall summary.

AUTOMATED LETTER REPLY TO EIR'S

This special letter "report" was developed to remove much of the workload of answering EIRS from office personnel. This letter "report" is initiated by request when a repetitive type EIR must be answered. A letter, from a file of letters, will be typed by the computer on regular bond typing paper. All letters in the file are addressed to specific problems so the EIR is answered in specific details and not by a general form letter.

FACILITY DIRECTORY

The Army Aircraft Maintenance Facility Directory offers a ready reference, on a world wide basis, of those units performing or having performed aircraft maintenance (Direct, General, or Depot echelon), and the level of their individually authorized capabilities. The units are listed by their Unit Identification Code (UIC) and by other titles. This Directory which will be held current on a semi-annual basis, requires validation and correction participation by the units and Commands organic to it.

CHAOS - CHRONOLOGICAL, HISTORICAL AIRCRAFT OWNERSHIP SUMMARY

This is a special report initiated by a request for information pertaining to an individual aircraft's owning unit, usage, and operating time per month. The CHAOS Report summarizes the information on DA Form 1352 into a month by month history of the aircraft indicating the total flight hours; the description of aircraft usage; the aircraft type, model, and series; and the owning unit at the end of each month.

RIADS - REPORTABLE ITEMS ACTION DATA SORTS

This report is initiated on a scheduled basis for selected time change, finite life, or condition components which are included in the DA Form 2410 reporting system. RIADS is designed to summarize and allow for a rapid comparative analysis of the reliability and maintainability characteristics of the detailed information included in the ACTION (Aircraft Component Time Since Installation, Overhaul, or New) report. Included in the report for each part number - federal stock number combination of a TMS (Type, Model, Series) are manhours required for installation, dominant failure code, reliability index (average operating hours per installation), and a maintainability index (average manhours required to install the component divided by the average operating hours per installation).

COMPONENT MASTER DATA SORTS

The Component Master Data Sorts is initiated for a particular TMS (Type, Model, Series) fleet upon request. This report lists the reported Part Number and Federal Stock Number, Failure Code, Number of Overhauls, Time Since New, Time Since Last Installation, and Manhours to Install for records submitted via DA Form 2410 to AVSCOM for the TMS fleet requested. The information is sorted in ascending Time Since New, Time Since Last Installation, and Manhours to Install sequence, so that the reported values of the manhour and usage data can be reviewed for time change, retirement life, and selected condition items.

MAJOR ITEM INSTALLATION STATISTICS

This is a scheduled report initiated for each TMS fleet. The information is arranged by major items (items which require DA Form 2410 submission) on a particular TMS fleet. Under each major item category the serial-numbered items are identified by FSN, Part Number, Army Area, Command and Organization. The pertinent installation statistics, such as, Time Since New, Time Since Last Installation, Time Since Last Overhaul, established time change, and the serial-numbered aircraft that the item is installed on are displayed. A summary for each major item category will be provided in a "Question" type format.

AIRCRAFT MAJOR ITEM CONFIGURATION

This is a scheduled report initiated for each TMS fleet. Each serial-numbered aircraft is arranged by Army Area, Command and Organization. For each serial-numbered aircraft the major items are identified by noun nomenclature, FSN, Part Number, and Serial Number. Pertinent installation and removal statistics, such as, Time Since New, Time Since Last Installation, Time Since Last Overhaul, established time change, and status (time remaining to time change) are displayed for each serial-numbered major item.

MAJOR ITEM REMOVAL STATISTICS

This is a scheduled report initiated for each TMS fleet. The information is arranged by major items (items which require DA Form 2410 submission) on a TMS fleet. Under each major item category the serial-numbered items are identified by FSN, Part Number, Army Area, Command, and Organization. The pertinent removal statistics such as, Time Since Last Installation, Time Since Last Overhaul, established time change, and the serial-numbered aircraft that the item was removed from are displayed. A summary for each major item category is provided in a "Question" type format.

FOCUS - FREQUENCY OF CRASHES AND UTILIZATION SUMMARY

This report is published monthly and combines the information included in the monthly Crash Facts Report with the accrued flight hours for each TMS fleet from the 1352 reporting system to provide statistical parameters concerning the frequency of aircraft accident/incidents. The parameters presented relate safety of flight reliability and include detailed breakdowns by Army Areas, Commands, and Organizations for rates of all and each type of accident/incident per flight hour and calendar day. In addition, charts are presented to display trends during the past year.

MIRF - MAJOR ITEM REMOVAL FREQUENCY

This is a scheduled report which reflects frequency of removals for those components which are included in the DA Form 2410 reporting system. A breakdown by fail code of the number of removals per flight hour interval is tabulated for each specific FSN and part-numbered component. Listings for those components with no prior overhauls and those with one prior overhaul are included. The average time since new or average time since overhaul is listed for each reported fail code. The total number of removals as well as percent of total removals is carried for each flight hour interval. The report is further divided with respect to failures (actual failed components) and non-failures (time change, removals to facilitate other maintenance, etc.).

MIT - MAJOR ITEM TRENDS

This report is initiated on a scheduled basis for selected time change, finite life, or condition items which are included in the DA Form 2410 reporting system. MIT is designed to summarize and allow for a rapid trend analysis of the reliability and maintainability characteristics of the detailed data presented in the ACTION (Aircraft Component Time Since Installation, Overhaul, or New), RIADS (Reportable Items Action Data Sorts), and MIRF (Major Item Removal Frequency) reports.

FIELD MAINTENANCE ACTIVITY REPORT

This report presents all maintenance activity associated with a particular aircraft for one quarter. Presented in the same format as the TALCMOR Special report, it will be submitted to the organization owning the aircraft on a quarterly basis. The report will be advantageous in verifying record submissions, presenting a concise tabulation of maintenance activity, helping to reconstruct lost records and allow for analyses at the local user activity.

MAJOR ASSEMBLIES COMPONENT INSPECTION REPORT

This report, prepared on a quarterly basis, will be a scheduled report. It will present pertinent component information on major assemblies that have been torn down and overhauled. It will provide more insight into the cause - effect relationship on major assembly failures, and delineate the shop procedures performed on an overhauled item. The data for the report will be acquired from existing data systems at overhaul facilities.

CYCLIC OVERHAUL ANALYSIS

This is a special report initiated to analyze the current UH-1D and UH-1H helicopter cyclic overhaul methods. The Cyclic Overhaul Report consists of five interim reports providing aircraft downtime time analysis, part number identification, maintenance trend analysis, Conditional Return philosophy, and Recommendations and Conclusions.

AIRCRAFT OPERATIONAL UTILIZATION - AOPU

The Aircraft Operational Utilization (AOPU) quarterly report provides:

1. Operational readiness (OR), not operationally ready maintenance (NORM) at direct and general support and organization, not operationally ready supply (NORS) percentages of calendar time and rates per flight hour and aircraft.

2. Aircraft assignment - functional name quantities and percentages of fleet. The above data will be provided for a fleet and those aircraft located in selected geographical areas for each of the last twelve months and a value averaged over the last twelve months.

This report also provides flight hour age distribution since new and since overhaul or new and calendar age distributions since new and since overhaul or new for a fleet and those aircraft located in selected geographical areas as of the date of the report.

REPORT TITLE	REQUEST OR SCHEDULED	OPERATIONAL STATUS COMMENTS	FLEETS AVAILABILITY
TALCMOR - The Aircraft Life Cycle Maintenance and Ownership Summary	R	OPERATIONAL	All
EIR Engineering Quarterly	S	OPERATIONAL Distributed internally AVSCOM	All
EIR Field Quarterly	S	OPERATIONAL Distributed externally AVSCOM	All
Depot Quarterly	S	OPERATIONAL	All
Automated Letter Reply to EIR's	R	OPERATIONAL	Participating
Crash Facts	S	OPERATIONAL	All
ACTION - Aircraft Component Time Since Installation, Overhaul or New	S	OPERATIONAL	All
RIADS - Reportable Items Action Data Sorts	S	OPERATIONAL	All

REPORT TITLE	REQUEST OR SCHEDULED	OPERATIONAL STATUS COMMENTS	FLEETS AVAILABILITY
Component Inspections	S	OPERATIONAL Oct 73	
Cyclic Overhaul Analysis	S	OPERATIONAL	UH-1H and UH-1D
Validation Report	S	OPERATIONAL Sep 72	All
Aircraft Major Item Configuration	S	OPERATIONAL Jan 73	All
GLIM - Gains and Losses in the inventory of Major Items	S	Dec 72	All
Major Item Removal Statistics	S	OPERATIONAL Dec 72	All
Major Item Installation Statistics	S	Oct 72	All
Major Item Trends	S	Apr 72	All
Manhour Reports	S	OPERATIONAL Oct 72	All

REPORT TITLE	REQUEST OR SCHEDULED	OPERATIONAL STATUS COMMENTS	FLEETS AVAILABILITY
TASIR - The Aircraft Selected Item Record	R	OPERATIONAL But presently in code format	All
CASIR - Chronological Analysis Selected Items Record	R	OPERATIONAL	All
CHAOS - Chronological, Historical Aircraft Ownership Summary	R	OPERATIONAL	All
CMDS - Component Master Data Sort	R	OPERATIONAL Not in narrative format - format form Oct 71	All
AOPU - Aircraft Operational Utilization	S	OPERATIONAL	
MIRF - Major Item Removal Frequency	S	OPERATIONAL	All
Directory of Support Units	S	OPERATIONAL	All Maintenance Units
FOCUS - Fequency of crashes and Utilization Summary	S	OPERATIONAL Jan 73	All