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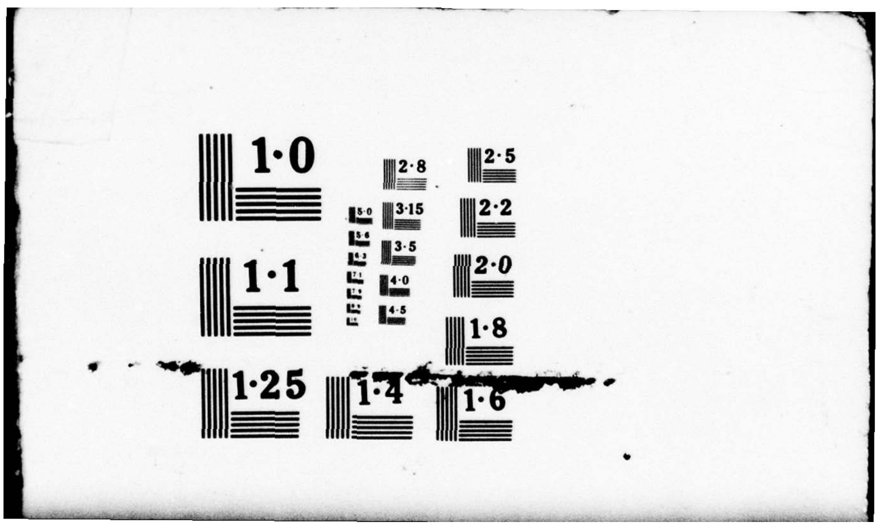
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This document is intended to prescribe an analysis procedure to be followed in order to determine the best maintenance plan for new weapons systems and their modifications. The in-service analysis utilized historical 3M and NAVSAFCEN data in order to evaluate and update the existing Maintenance Plans. The goals are to provide the organizational focus and systematic procedures to (1) analyze the scheduled maintenance requirements for each type/model aircraft, (2) objectively justify every maintenance requirement, and (3) enforce the performance of only the justified maintenance actions.

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AIRCRAFT MAINTENANCE PLAN ANALYSIS

1 March 1976

MAINTENANCE POLICY AND ENGINEERING DIVISION

NAVAL AIR SYSTEMS COMMAND
WASHINGTON, D.C. 20361

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1.0 INTRODUCTION

1.1 Maintenance Planning

Maintenance planning data has been part of MEA (Maintenance Engineering Analysis) and, therefore, part of all Integrated Logistic Support documentation since the issuance of BUWEPS document WR-30 in May 1963. The MEA data was rarely delivered. The contractor generally held the documented results which were called MEAR's (Maintenance Engineering Analysis Records). With the issuance of NAVAIR document AR-30A, the concept of delivering some of the Logistic Support Analysis data in the form of Maintenance Plans was established. In addition, NAVAIRINST 4790.4 series was generated, which expanded the policy of Maintenance Plans to in-service equipment, thereby establishing Maintenance Plans as a life cycle logistic element. This document is intended to prescribe an analysis procedure to be followed in order to determine the best Maintenance Plan for New Weapons Systems and their modifications. This document delineates the analysis procedure to be utilized in developing Maintenance Plans in accordance with AR-30A and/or NAVAIRINST 4790.4 (series). The entire effort satisfies the requirements of MIL-STD-1388, Logistic Support Analysis, in the area of Maintenance Planning. Another handbook, "Maintenance Plan Analysis Guide for In-Service Aircraft" (NAVAIR 00-25-400), is available which provides an analysis procedure to be followed for in-service equipment. The in-service analysis utilized historical 3M and NAVSAFCEN data in order to evaluate and update the existing Maintenance Plans.

1.2 Analytical Maintenance Program

These analysis processes are part of the Naval Air Systems Command project AMP (Analytical Maintenance Program). The goals are to provide the organizational focus and systematic procedures to (1) analyze the scheduled maintenance requirements for each type/model aircraft, (2) objectively justify every maintenance requirement, and (3) enforce the performance of only the justified maintenance actions. AMP provides the means to comply with OSD (Office of Secretary of Defense) and CNO (Chief of Naval Operations) planning and programming guidance, and at the same time is the basis of coordination necessary to implement and sustain all viable, progressive, cost-effective improvements in the Naval Aviation Maintenance Program.

1.3 Background

In July 1968, representatives of various airlines which constituted the MSG (Maintenance Steering Group) developed the "Handbook MSG-1, Maintenance Evaluation and Program Development", that included decision logic and intraairline/aircraft manufacturer procedures for developing scheduled maintenance programs for the new Boeing-747 aircraft. Subsequently, it was decided that experience gained on this project should be applied to update the decision logic and to delete certain 747 detailed procedural information to make a universal document applicable to the development of scheduled maintenance programs on new procurement aircraft. The product of this effort is known as the "Airline Manufacturers Maintenance Program Planning Document -- MSG-2". As the regulatory agency for civilian aircraft, the FAA (Federal Aviation Administration) published MSG-2 in the FAA 8310.4 series instruction entitled "Maintenance Certification Procedures" and provided criteria for the application of MSG-2 to existing fleets of aircraft. The recent developments and implementation of the following programs within the naval aviation community has, to a certain extent, paralleled the airline industries effort:

a. The Engineering Cognizance Program

b. The ASMRA (Adjustment of Scheduled Maintenance Requirements Through Analysis) ADP Techniques utilizing 3M and Safety Center data.

c. Depot-level Maintenance Data Collection System

d. P-3 Improved Maintenance Program

e. S-3 Advanced Maintenance Program

f. Phased Maintenance Program

g. Hourly Engine Maintenance Program

h. Maintenance Plan Program

The above listed programs (including the airline MSG-2 principles) have all been integrated into AMP under the guidance of NAVAIR AIR-411, Maintenance Policy and Engineering Division.

1.4 Maintenance Plan Derivation

In actuality the process by which the Maintenance Plan is derived is called the Maintenance Plan Analysis (MPA) and replaces a portion of Maintenance Engineering Analysis (MEA). Maintenance Engineering Analysis is now called Logistic Support Analysis; therefore, MPA is part of Logistic Support Analysis.

2.0 REFERENCED DOCUMENTS

The following documents form a part of this document to the extent specified herein.

a. Military Standards

MIL-STD-780D	Work Unit Codes and Maintenance Engineering Analyses Control Numbers (MEACNs) for Aeronautical Equipment Uniform Number System dtd 1 July 1972
MIL-STD-1390A	Level of Repair dtd 1 April 1974

b. Naval Air Systems Command Instructions

NAVAIRINST 4423.3A	Joint Service Uniform Source, Maintenance and Recoverability (SM&R) Codes dtd 17 October 1972
NAVAIRINST 4790.3	SRC (Scheduled Removal Component) Program for Aeronautical Component dtd 15 February 1973
NAVAIRINST 13700.6A	Gas Turbine Engine, Three Degree Intermediate Level Maintenance Program dtd 5 January 1972

3.0 OVERVIEW

3.1 Derivation

The Maintenance Plan is derived through a series of analyses via a process known as MPA (Maintenance Plan Analysis). This process is done at the contractor's site during the development of a new weapon system or equipment.

3.2 MPA

The analysis process is accomplished by utilizing a series of MPA Worksheets. When these worksheets are completed all data necessary to justify and determine the Maintenance Plan will be visible. There are a total of ten worksheets. The worksheets with basic functional descriptions are as follows:

MPA Worksheet 1 - Significant Items Determination
MPA Worksheet 2 - Failure Modes and Effects Analysis
MPA Worksheet 3 - Hardware Usage Development
MPA Worksheet 4 - Potential Scheduled Maintenance Requirement Development
MPA Worksheet 5 - Scheduled Maintenance Requirements
MPA Worksheet 6 - Scheduled Maintenance Requirements Task Analysis
MPA Worksheet 7 - Failure Causes and Restorative Action
MPA Worksheet 8 - GSE/SM&R Code Development
MPA Worksheet 9 - Economic Level of Repair Analysis Results
MPA Worksheet 10- SSI (Structural Significant Item) Analysis

From information that is entered onto these worksheets, the Maintenance Plan is generated. It must be emphasized that the Maintenance Plan is the prime document and that the MPA process is the method by which the Maintenance Plan is created.

3.3 MPA Procedural Overview

The process by which a Maintenance Plan is developed employs successive steps. It is first necessary to determine what hardware is to be analyzed. Appendix I contains the "ordering" of Maintenance Plans within an aircraft weapon system.

Each Maintenance Plan and related MPA is accomplished by an aircraft functional system as described in Appendix I. The first process step identifies and relates significant items to the end item functional system. The identification of all potentially repairable components and items that may have scheduled maintenance requirements within the subject functional system is required to be listed. This listing identifies the potential maintenance significant items (MSI) to be considered throughout the analysis process. The second process step is to perform a Failure Mode and Effects Analysis on each potential MSI and develop failure, removal and BCM (Beyond Capability of Intermediate Maintenance) rate curves for each weapons replaceable assembly. The third process step is to determine the <u>scheduled</u> MSI and their <u>scheduled</u> maintenance requirements associated with the item failure modes and effects based on modified MSG-2 logic as summarized in Figure 4. The fourth process stage is to determine the corrective MSI and their corrective maintenance requirements associated with the item failure modes and effects.

The results of these processes allow all maintenance requirements to be generated for each finally determined MSI. In order to establish the MSI and develop the maintenance requirements, the procedure employs the systems approach, where it is necessary to view the subsystem, equipments, components, and items/parts contained within the systems/equipments and structure. This not only identifies directly how each item functionally relates to, and is dependent upon another, but structures the analysis process to provide maintenance requirements related to specific hardware within the parent system or structural assembly. The process has then, at this point, fulfilled the most complex requirements of the Maintenance Plan, i.e., the identification of the repairable/inspectable items and all their related maintenance requirements.

Now the process addresses each maintenance requirement which relates to specific hardware inspection/repair actions in terms of hardware requirements (ground support equipment and repairable parts usage) and the maintenance levels authorized to accomplish each specific action. The Level of Repair analysis procedure of MIL-STD-1390 (series) is utilized to aid in the repair determinations along with historical like equipment repair and usage data available through the 3M system and supply support records. Upon completion of this step the data required for generation and justification of a maintenance plan is available.

3.4 MSG-2 Highlights

The Scheduled Maintenance Requirements established through the MSG-2 logic fall into one of two categories, hard time or on-condition. The items having no scheduled maintenance requirements are in the "Condition Monitoring" category. All on-condition maintenance requirements are periodic inspections or tests which measure the deterioration of an item and, based on the deterioration level, either require refurbishment or determine acceptable item operation. Therefore, it is mandatory that an item exhibit a detectable deterioration before failure when an on-condition scheduled maintenance requirement is established. "Hard Time" is the airline term for forced removal item; Scheduled Removal Component (SRC) is the Navy equivalent term. NAVAIRINST 4790.3 describes the Navy SRC program.

SRC's must show, in addition to being justified on an operating safety, hidden function, or economic removal criteria, that the replacement item/equipment exhibits at least the same reliability protection for the system as the item that is removed. Equipment that is classified as operating safety or hidden function must have scheduled maintenance requirements and must prove that the scheduled test or inspection requirements will ensure the continued availability of the item through the next in-service period. Zonal inspections are accomplished on a periodic basis to assure integrity. When inspecting/testing/removing an item/equipment on a scheduled basis, it may be advantageous to perform a concurrent ZONAL. Otherwise ZONALS are performed as specific scheduled maintenance requirements. For corrective maintenance requirements, it is mandatory that the fault be isolated to an item/equipment from a system, then the requirements and the maintenance level which may effect economical repair of each item/equipment be identified. These requirements shall be of sufficient detail to allow complete repair, overhaul, conditional overhaul, etc. procedures to be specified thereby determining those minimum maintenance requirements necessary to restore inherent design levels.

3.5 Maintenance Plan

The Maintenance Plan itself is divided into three parts. These parts and their functional description are as follows:

3.5.1 Part One - General Considerations

Section 1 Describes the Maintenance Plan subject design characteristics

Section 2 Provides a Maintenance Plan summary at all levels of repair

Section 3 Documents the plan rationale, the why of the plan

3.5.2. Part Two - Repair Capability

Lists all the repairable items within the system and details the Source, Maintenance and Recoverability (SM&R) Code, Maintenance Replacement Factor (MRF), Depot Recovery Factor (DRF), System Recovery Factor (SRF), and Rotable Pool Factor (RPF) for each repairable item.

3.5.3 Part Three - Maintenance Requirements

Lists all the maintenance requirements of the system and identifies the maintenance level, interval, and Ground Support Equipment (GSE) needed to perform each requirement.

3.6 Interim Maintenance Plan

When the requirements of the Maintenance Plan cannot be implemented at fleet introduction because of a lack of one or more logistic capabilities, e.g. GSE, publications, spare parts, training, then an Interim Maintenance Plan shall be attached to the Maintenance Plan. This Interim Maintenance Plan will describe the differences in support required until the deficiency is removed. It shall be recinded when the Maintenance Plan is implemented.

4.0 DETAILED DESCRIPTION

4.1 MPA Process

The MPA process is a complete analysis of the maintenance and support requirements as determined through the characteristics of the design and function of the system under analysis. This is accomplished by using the MPA Worksheets. By following the instructions for each worksheet, the Maintenance Plan will then have all the data necessary to justify each entry. See Appendix II for the entire series of MPA Worksheets.

The MPA Worksheets are divided into three groups:

The first group provides the hardware order listing to be considered throughout the rest of the analysis, the hardware design and function information (MPA 1); the failure modes and effects analysis data for all the hardware listed (MPA 2); and the predicted failure/removal/BCM (Beyond Capability of Intermediate Maintenance) rates for each WRA (Weapons Replaceable Assembly) contained within the hardware listed (MPA 3). This data is contained on MPA Worksheets 1, 2 and 3 and is called the <u>BASIC</u> <u>GROUP</u> because the data is pertinent to both scheduled and corrective maintenance determinations.

The second group contains the data resulting from answering the MSG-2 logic for all the hardware listed and the potential effective scheduled maintenance requirements stemming from YES answers to MSG-2 logic questions (MPA 4); the final determined scheduled maintenance requirements <u>to</u> <u>be</u> <u>done</u>, their frequency (interval), maintenance level, and the ground support equipment required to accomplish each scheduled maintenance requirement (MPA 5); and the tasks, estimated elapsed time, estimated number of people, ground support equipment, services, inspection limits and test requirements for each scheduled maintenance requirement <u>to</u> <u>be</u> <u>done</u> (MPA 6). This data is contained on MPA Worksheets 4, 5 and 6 and is called <u>SCHEDULED</u> <u>MAINTENANCE</u> <u>GROUP</u>.

The third group contains the failure cause data and the restorative action required to correct every failure mode for every hardware item listed, a predicted percent occurrence for each cause (below the WRA level) (MPA 7); the maintenance level and ground support equipment required to fault isolate, remove/replace, check/test and restore each failure mode cause (MPA 8); and the predicted failure rate, predicted removal rate, predicted purchase cost and the total life cycle predicted cost for repair I/repair D/split I/discard options based on the predictions and the application of the Level of Repair Analysis for each hardware item listed (MPA 9).

An additional worksheet (MPA 10) contains information required for Structural Significant Item Analysis. This data is contained on MPA Worksheets 7, 8, and 9 and is called the CORRECTIVE MAINTENANCE GROUP.

All MPA Worksheets have the same heading information requirements as follows:

block (a) - The maintenance plan candidate nomenclature and part number as per Appendix I (Maintenance Plan Candidates).

block (b) - The work unit code or logistic support analysis control number for the maintenance plan candidate.

block (c) - The names of the persons preparing the MPA Worksheets, the preparers' activity/company; the aircraft application(s) of the maintenance plan candidate; the completion date of the MPA; the revision letter and the revision date, if applicable.

4.2 MPA Basic Group Worksheet Completion Direction

4.2.1 MPA Worksheet 1 - Significant Items Determination

It is first necessary to determine what hardware groups are to be analyzed by the process described herein. The analysis process employs the functional group approach at the S/E, S (System/Equipment, Structure) level. The s, c, i/p (subsystems, components, and items/parts) contained within the S/E, S are to be viewed as they functionally relate to each other in the ability of each S/E, S to perform its function(s).

Maintenance Plans are to be generated for each functionally independent S/E, S (FUNCTIONAL GROUP); therefore, the MPA is accomplished by the same functional groups. All associated electronic devices, electrical wiring, hydraulic tubing, pneumatic lines, control linkages, mounting brackets, etc., that are associated with an item's ability to perform its intended function must be included in the analysis under a given S/E, S. This results in a physical separation of hardware items that are potential Maintenance Significant Items within functional groups.

Maintenance Significant Items (MSI) are items within the functional group that (after the analysis) are determined to have SCHEDULED MAINTENANCE REQUIREMENTS and/or are REPAIRABLE.

If the MPA is only to consider a subsystem or component within a functional group, then the MPA Worksheets will be placed under a cover sheet with the functional group title at the top and blocks identifying all subsystems within the group with notations regarding the inclusion/exclusion in the analysis of each subsystem. See Figure 1 for the cover sheet example.

Generate a hierachial hardware ordering of the functional group in terms of potential Maintenance Significant Items (MSI). These are only items that may have <u>scheduled maintenance requirements</u> or could be <u>repairable</u>. Do not list piece parts. List the functional group at the top of the list. Arrange the list as follows:

- Functional group nomenclature (nomen) and part number (P/N)
- Subsystem 1 nomen and P/N
- Potential repairable component 1 of subsystem 1 nomen and P/N
- All potential repairables within component 1 nomen and P/N
- Potential scheduled maintenance consumable items within component 1 nomen and P/N
- Potential repairable component 2 of subsystem 1 nomen and P/N
- All potential repairables within component 2 nomen and P/N
- Potential scheduled maintenance consumable items within component 2 nomen and P/N
- Subsystem 2 nomen and P/N

etc.

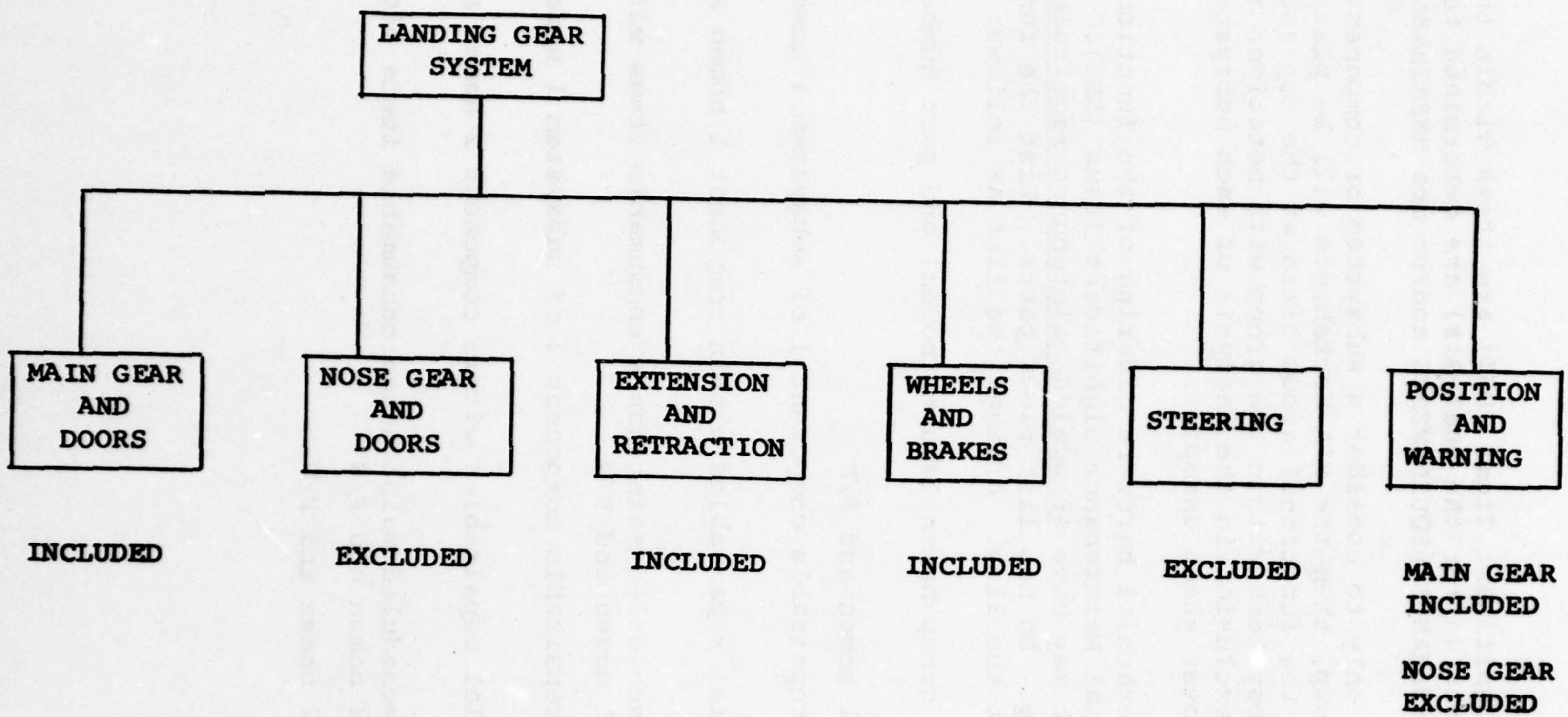


Figure 1. COVER SHEET EXAMPLE

At the end of this listing, list any potential repairable items or potential scheduled maintenance consumable items that are not considered part of a subsystem but are part of the functional group. (An example of a potential scheduled maintenance consumable item is the aircraft tail hook.)

Enter this hardware order nomen and P/N in blocks (e) and (f) of MPA Worksheet 1. Assign a sequence number in block (d) to each item listed. This sequence number will be used to identify the potential MSI under consideration on other MPA Worksheets. Assign a WUC (Work Unit Code) or LSACN (Logistic Support Analysis Control Number) to each listed potential MSI in accordance with MIL-STD-780 (AS) in block (g). Enter a concise but clear description of the function of each potential MSI, denoting input/output tolerances or values, vibration or stress limits, and any other potentially limiting factors in block (i).

List other items which are redundant or provide protection or failsafe features to the function of the item in question in block (j). These devices can be flags, lights, gauges, overheat switches, etc.

In order to facilitate grouping scheduled maintenance requirements, each aircraft is to have work area zones assigned. If the MPA is being accomplished on a system(s) which relates to an aircraft having no previous zone assignments, then the zone column is left blank. If the MPA is to cover a complete aircraft, zone assignments are to be made. If the aircraft has previous zone assignments, these zones are to be used. The NAVAIR maintenance engineer will provide previous zone assignment information.

Zone determination shall be established on the lines of bulkheads and established structural boundaries. When final determination is made, clearly describe the lateral, longitudinal and vertical limits for each zone.

Zones shall be randomly assigned for each aircraft, starting from the point of entrance to the aircraft and proceeding in a clockwise manner. The zones shall be numbered in sequential numerical order and their limits documented. Because of the varying size of aircraft procured for naval use, it is impossible to establish a distinct set of guidelines applicable to all aircraft. The zones are intended to be only a work area locator to provide ease of location for maintenance personnel. They are not intended to be specific, rather they are to be general in nature, e.g., Zone 1 -- nose, random area; Zone 2 -- forward fuselage, right side; Zone 3 -- inner wing panel, right side; Zone 4 -- right engine, pylon, etc. Generate a zone pictorial as a backup sheet when applicable. (See Figure 2).

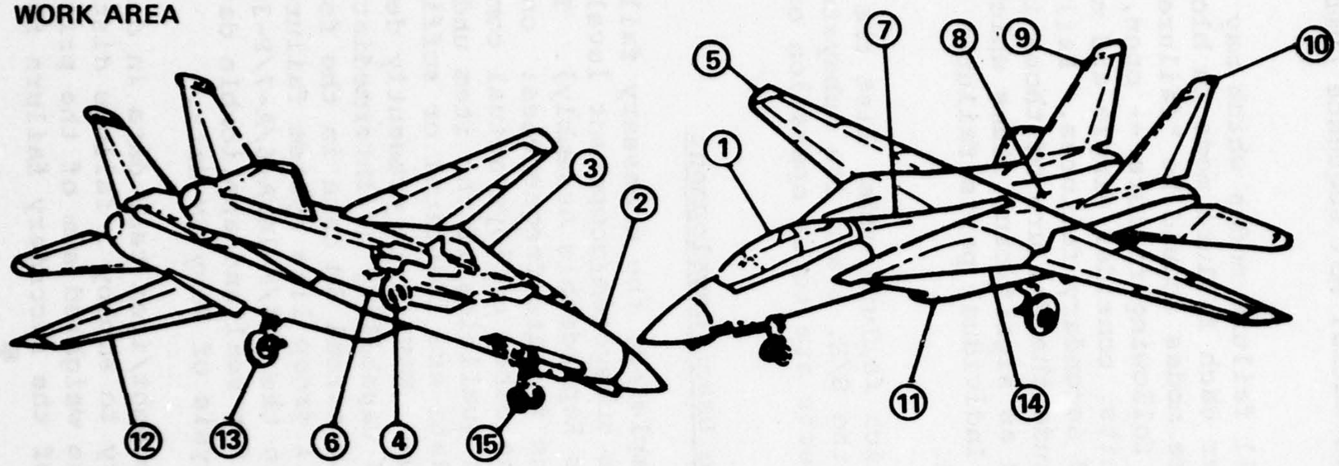
The Significant Item block (k) on MPA Worksheet 1 is not to be completed until the analysis results become visible. This block is used to identify those potential MSI which after or during the analysis are determined to have scheduled maintenance requirements TO BE DONE and/or are determined to be repairable. Each column of block (k) will be filled in with a YES or NO depending on the analysis results. The analysis will indicate when this block is to be completed.

4.2.2 MPA Worksheet #2 FMEA (Failure Modes and Effects Analysis)

The FMEA is performed on all potential MSI listed on MPA Worksheet 1 and the results are utilized in both the scheduled and corrective maintenance requirements determination processes.

In performing the FMEA on MPA Worksheet 2, it is necessary to view the equipment in two respects: (1) from the S/E, S upward to the end item relationship and (2) from the S/E, S to the s, c, i/p relationship. The S/E, S to end item relationship addresses the ability of the S/E, S to perform its function(s) and the resultant effect(s) on that function(s) due to failures. In this regard, it is necessary to specify any potential domino effect(s) that the S/E, S has upon another S/E, S, whether it be upstream or downstream and/or contains redundancies, alternatives and/or protective devices. The S/E, S to s, c, i/p relationship relates to the various internal failures and their failure modes that could happen within the various subassemblies and components of an S/E, S. In either case, all failures that will lead to loss of function, or degradation of the S/E, S function shall be identified. In this analysis step, failure frequencies or probabilities of failure are not addressed; only failures shall be studied.

WORK AREA



1. COCKPIT
2. FORWARD FUSELAGE AND NOSE RADOME
3. RIGHT WING GLOVE AND SPONSON
4. RIGHT MAIN LANDING GEAR AND WHEEL WELL
5. RIGHT WING
6. RIGHT INTAKE DUCT, ENGINE, ENGINE BAY, AND AFTERBURNER
7. CENTER FUSELAGE
8. AFT FUSELAGE
9. RIGHT HORIZONTAL AND VERTICAL STABILIZERS AND RUDDER
10. LEFT HORIZONTAL AND VERTICAL STABILIZERS AND RUDDER
11. LEFT INTAKE DUCT, ENGINE, ENGINE BAY, AND AFTERBURNER
12. LEFT WING
13. LEFT MAIN LANDING GEAR AND WHEEL WELL
14. LEFT WING GLOVE AND SPONSON
15. NOSE LANDING GEAR AND WHEEL WELL

FIGURE 2. EXAMPLE OF AIRCRAFT ZONE ASSIGNMENTS

Complete the FMEA on MPA Worksheet 2 as follows:

In block (d) relist all potential MSI sequence numbers listed on MPA Worksheet 1 block (d).

Failure Mode(s) - List all failure modes which may occur to this item in block (e). Number each failure mode in block (e) for ready reference. These failure modes should be "failure state" oriented, i.e., the condition following failure -- open, closed, unstable, etc. If multiple units, consider single and multiple failures. Include primary and secondary failures. Failure modes for subsystems should not include the failure of those individual components that are classified as significant items which are subject to individual analysis. Individual parts failures or parts condition are not to be listed.

Failure Effect(s) - For each failure mode, list the effect on the end item equipment and on the S/E, S and its subsystems and components in block (f). The effects are to be operation or performance oriented.

4.2.3 MPA Worksheet #3 Hardware Usage Development

Once the FMEA has been completed, the necessary failure frequencies are to be developed at the subsystem/component level (commonly referred to as the WRA- Weapons Replaceable Assembly). There are two principle means to determine failure frequencies: one employs real and applicable data and the other employs actual component test data. Real and applicable data qualifies if the item under analysis and the item described by the data are identical or sufficiently similar that an analogy can be drawn. NAVAIR is presently developing a WRA failure/removal/BCM (Beyond Capability of Intermediate Maintenance) frequency handbook utilizing historical 3M data in the format of MPA Worksheet 3. This handbook will group like system failure-removal-BCM characteristics for WRA's in the F-4/F-14/A-6/A-7/P-3 aircraft. The handbook is to be utilized for real and applicable data inputs to this analysis or a like analysis of Navy 3M data.

When employing actual component/item test data in deriving failure rate values, it is necessary to employ a failure distribution model which shall be a function of the weighted sum of the primary failure frequencies, the weighted sum of the secondary failure frequencies, and the weighted sum of the tertiary frequencies. Primary failures are those failures, everything else being equal, that occur within the item, by the item, exclusively dependent upon some recognized time dependent and measurable parameter(s) with NO external influences. Secondary failures are those failures caused by other equipment items within the system. Tertiary failures are those failures that are induced failures, and/or false removals caused by environment maintenance, faulty ground support equipment/ diagnostics aids, misuse/abuse, etc. Once the various frequencies have been established for an item, they must be statistically combined to produce corrective maintenance frequency curves needed for this analysis effort.

The frequency curves shall be in the same format as the removal/ failure/BCM rate example curves on MPA Worksheet 3. Each curve must be extrapolated to at least the equivalent of eighteen months in-service experience in terms of flight hours.

From the curves above and from the historical 3M data on like systems, construct predicted removal/BCM/failure curves for each potential MSI which is classified as WRA (Weapon Replaceable Assembly). A separate MPA Worksheet 3 is required for each WRA. Identify each MPA Worksheet 3 by placing the WRA potential MSI sequence number at the top.

This ends the BASIC GROUP analysis portion of the MPA.

4.3 MPA Scheduled Maintenance Group Worksheet Completion Direction

4.3.1 MPA Worksheet 4 - Potential Scheduled Maintenance Requirements Determination

4.3.1.1 As a lead-in to the application of the MSG-2 logic, seven questions are asked of every potential MSI. For identification these questions are called GROUP 7 QUESTIONS. There are GROUP 5 and GROUP 3 QUESTIONS to be explained later. Figure 3 identifies Question Groups and describes their relationships. Of the GROUP 7 QUESTIONS, the first six apply to all potential MSI while the last question is applicable to all structural items (both static aircraft structure and engine structure). A YES answer identifies the item as a potential SCHEDULED MSI to which the MSG-2 logic is applied. On MPA Worksheet 4 block (d) list all potential MSI sequence numbers. Ask the seven questions of each potential MSI. Document the results of these questions on MPA Worksheet 4

GROUP 7 QUESTIONS

1. Does the item have safety of flight or personnel implications?
2. Will the loss of this item not allow for the continued functioning of this system?
3. Does the item possess or depend upon a hidden function?
4. Is the item essential to mission accomplishment?
5. Does experience data on either identical or similar items show a high maintenance action rate per usage hour, cycles or calendar time?
6. Is the item vulnerable to failure by corrosion?
7. Is the item vulnerable to failure by fatigue?

GROUP 5 QUESTIONS
Ask for any item having one or more yes answers to GP 7 questions. Refer to Figure 4 for question relationship

1. Is the reduction in failure resistance detectable by routine flight crew (or operating personnel) monitoring?
2. Is the reduction in failure resistance detectable by on-aircraft maintenance or unit test?
3. Does the failure mode have a direct adverse effect upon operating safety?
4. Is the function hidden from the viewpoint of the flight crew (or operating personnel)?
5. Is there an adverse relationship between age and reliability?

GROUP 3 QUESTIONS
Ask for any item having yes answers to GP 5 questions 2 or 5. Refer to Figure 4 for question relationship

1. Does real and applicable data show the desirability of a scheduled task?
2. Does the failure prevent mission accomplishment?
3. Is the elapsed time for correction with in 1/2 hour?

Figure 3. MAINTENANCE SIGNIFICANT ITEM SCHEDULED ANALYSIS

block (e) by writing in block (e) the question number of YES answers. Under the question numbers note "SSI" for each determined Structural Significant Item. An SSI is an MSI covering areas of primary fixed structure which are judged to be most important from a fatigue or corrosion vulnerability standpoint or from a failure effects standpoint. SSI's are the subject of an additional analysis in which the inspection requirements and frequency are established.

THE GROUP 7 QUESTIONS ARE:

Question 1: Does the item have safety-of-flight or personnel implications? Here, it must be determined if the failure of this unit to do its intended function will immediately jeopardize the end item equipment, aircraft or personnel. It must also be considered whether there is a redundant like item which can perform the item's function.

Question 2: Will the loss of this item not allow for the continued functioning of this system?

Question 3: Does the item possess or depend upon a hidden function?

A component is considered to have a "hidden function" if either of the following exists:

a. The component has a function which is normally active whenever the system is used, but there is no indication to the flight crew when that component ceases to perform.

b. The component has a function which is normally inactive and there is no prior indication to the flight crew that the function will not perform when called upon. The demand for active performance will usually follow another failure and the demand may be activated automatically or manually.

Question 4: Is the item essential to mission accomplishment? For aircraft with multi-mission capability a matrix shall be developed using as the header a listing of all the possible missions. For systems a simple discussion format is to be used.

The matrix is constructed as follows:

Down the left-side, list the aircraft functional groups. Each possible mission shall be analyzed for each item listed on the left placing an "X" in the appropriate space formed by the matrix when it is determined that the item is essential to mission accomplishment. This matrix must be used whenever a MESL (Mission Essential Subsystem List) is required or whenever a mission accomplishment question arises.

Question 5: Does experience data on either identical or similar items show a high maintenance action rate per usage hour, cycles, or calendar time?

Question 6: Is the item vulnerable to failure by corrosion? This includes all types of corrosion induced by the environment, and the potential of corrosion inducement through the chemical/metallurgical process used in the production of the base material or in the fabrication of the item.

Question 7: Is the item vulnerable to failure by fatigue?

4.3.1.2 <u>Application of the MSG-2 Logic</u>

The rest of the potential schedule maintenance requirements development concern only those potential MSI which receive a YES answer to one or more of the GROUP 7 QUESTIONS. For all listed potential MSI having NO answers to all GROUP 7 QUESTIONS, place NO in the corresponding MPA Worksheet 1 block (k) "SCHED" column.

It is possible that as the analysis continues other items may be found that are considered significant with regard to the criteria of the above questions and it is also possible that some of the items will lose YES answers. The data on MPA Worksheet 1 will be continuously updated as the analysis continues and the resulting Maintenance Plans will address only those having YES answers in either one or both of the columns of block (k) on the final MPA Worksheet 1.

The scheduled maintenance requirements to be established fall into one of two categories: hard time (forced removal) items (called Scheduled Removal Components (SRC) items as per NAVAIRINST 4790.3) and on-condition items (items that are inspected periodically and maintenance is accomplished based on the condition found during the inspection).

The determination of scheduled maintenance requirements in accordance with MSG-2 logic is accomplished in a three-phase process that must be done in sequential order (See Figure 4). Although the basic process is applied to all systems/equipments, there are special applications and considerations applicable to structural items that shall be noted. Noted areas shall modify the specific section or question referenced.

The initial phase of the scheduled maintenance requirements determination is the evaluation of each failure mode and effect, for each potential MSI, having at least one YES answer on MPA Worksheet 4 block (e). The object of this is to determine those scheduled maintenance requirements having "potential effectiveness" relative to the control of operational reliability, safety, and mission capability. The result of this evaluation identifies those scheduled maintenance requirements that CAN BE DONE (Figure 4, Part A), which includes those requirements that may be mandatory, economically justifiable, or desirable. Process Parts B and C analyze the Part A potentially effective scheduled maintenance requirements to identify those that must and those that should be done. To determine the Part A scheduled maintenance requirements, there are five questions that must be individually answered for each failure mode and effect associated with each potential scheduled maintenance significant item having at least one YES answer to the GROUP 7 QUESTIONS. The results of these questions shall be documented on MPA Worksheet 4 in block (f). The determined potentially effective Scheduled Maintenance Requirements shall be documented on MPA Worksheet 4 block (i). Transfer failure mode numbers from MPA Worksheet 2 to MPA Worksheet 4 block (h) for YES answers to GROUP 5 QUESTIONS.

GROUP 5 QUESTIONS - The five questions for "CAN BE DONE" scheduled maintenance requirements are documented on MPA Worksheet 4 by placing the question number for all YES answers in block (f).

Question 1: Is the reduction in failure resistance detectable by routine flight crew (or operating personnel) monitoring?

YES answers mean that there are methods available to detect incipient conditions before undesirable system effects occur. An accurate determination must be made to ensure that the time between detection/indication and failure is such that corrective action can be taken. If the action can be taken prior to failure,

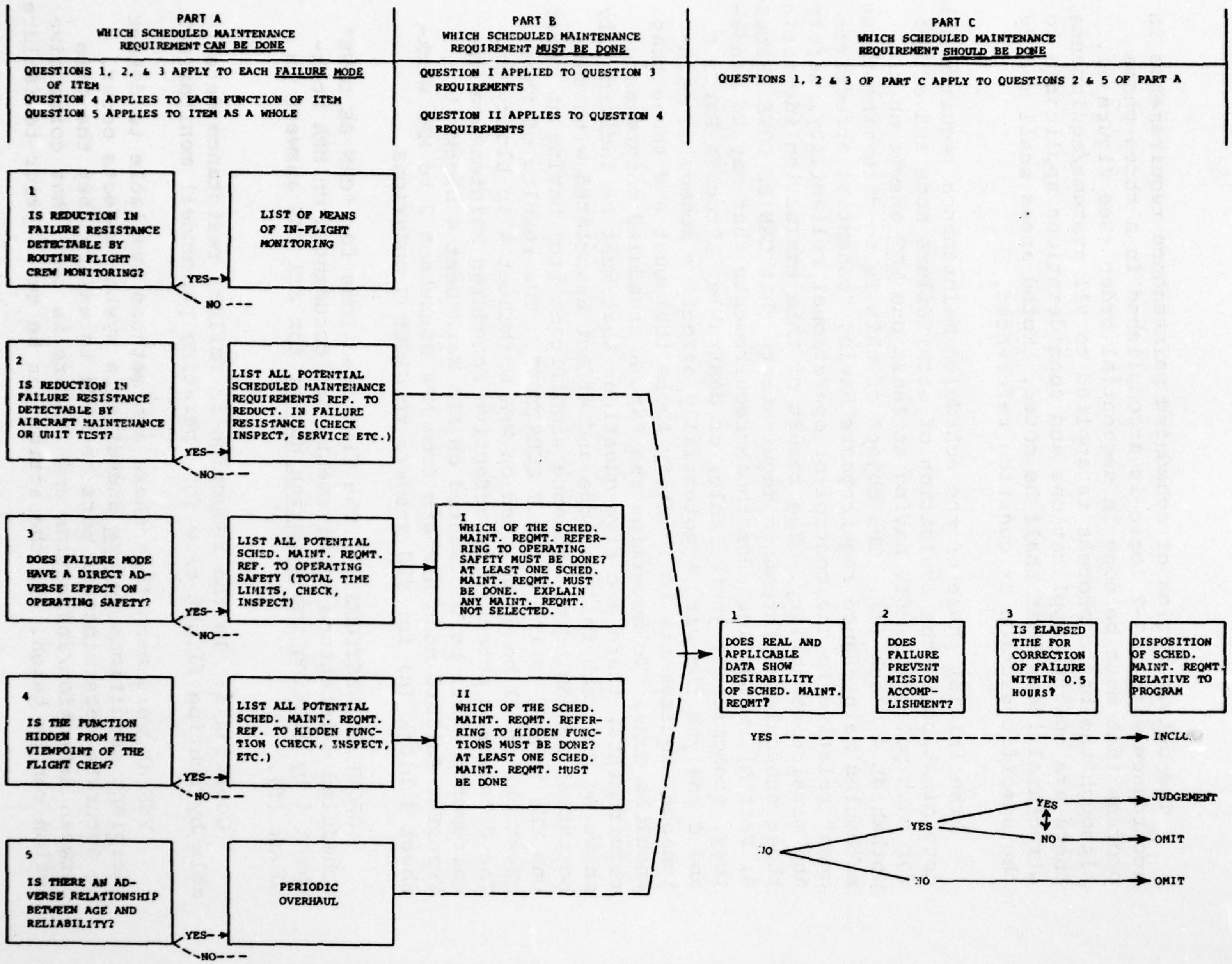


FIGURE 4 SCHEDULED MAINTENANCE DECISION DIAGRAM

note this item for inclusion into the applicable NATOPS publication. Document the scheduled maintenance requirement that provides the means of monitoring on MPA Worksheet 4 block (i). Include a notation that identifies this requirement as a flight crew responsibility in lieu of maintenance personnel responsibility.

NO answers mean that there is no inflight (or operational) monitoring available that can detect a reduction in failure resistance. Technological improvements and advances in inflight diagnostics will have a significant impact upon this area. However, for NO answers, other means must be employed for determining incipient conditions.

Question 2: Is the reduction in failure resistance detectable by on-aircraft maintenance or unit test?

Note: For structural items, including both airframe and engine, refer to the analysis process used in assigning R numbers (structure criticality rating) in paragraph 4.3.1.3.

YES answers mean that there is a scheduled maintenance requirement that has a potential effectiveness in determining incipient conditions before undesirable effects occur. Each potentially effective scheduled maintenance requirement shall be listed on MPA Worksheet 4 block (i). Further determinations must be made. The first determination relates to the amount of disassembly required, if any, to accomplish the scheduled maintenance requirement. The second determination relates to the time span from first possible positive indication/detection of impending failure to the failure itself. The second determination is employed to identify whether there is sufficient span of time to allow the scheduled maintenance requirement to be satisfactorily performed. It is expected that all redundant external and internal structures will be in this category.

NO answers mean there are no available means to maintenance in the determination of a reduction in failure resistance <u>prior to failure</u>; therefore, a scheduled maintenance requirement would be of little benefit.

Question 3: Does the failure mode have a direct adverse effect upon operating safety?

The following elaborates on the term "direct adverse effect on operating safety":

During the design process, considerable attention is given to system and component failure effects analysis to ensure that failures that result in loss of function do not immediately jeopardize operating safety. In many cases, redundancy can cause the consequences of a first failure to be benign. In other cases, protective devices serve this purpose. Although it may not be possible to continue to dispatch the airplane without correcting the failure and although it may indeed be desirable to make an unscheduled landing after failure, the failure cannot be considered to have an immediate adverse effect upon operating safety. The inclusion of the word "direct" in the phrase "direct adverse effect upon operating safety" means an effect which results from a specific failure mode occurring by itself and not in combination with other possible failure modes. Include in the considerations any failure which could have a potential safety implication to maintenance personnel.

For YES answers, it is necessary to examine the mechanism of failure to identify the single cells or simple assemblies where the failure initiates. Specific total time/cycles/etc. limitations may be assigned those single-celled or simple assemblies so that the probability of operational failures will be minimized. It is expected that non-redundant primary structures will be in this category. Examples of other items are high pressure hot air bleed duct seals, helicopter rotor blades, ejection seat actuating cartridges, wheel/tire assemblies, etc. Fortunately, there are only a small number of failure modes which have a direct adverse effect on operating safety due to the fact that failure modes analyses are conducted through the design process. In most cases, it is possible to make design changes (redundancy, incorporation of protective devices, better materials, etc.) which eliminate its direct adverse effect on operating safety after the identification of such a failure mode. The scheduled maintenance requirements that result from the YES answer shall be listed on MPA Worksheet 4 block (i) and will become part of either the hardtime or on-condition maintenance process. At least one effective scheduled maintenance requirement shall be listed for each YES answer. Should it be determined that an item's failure mode has a direct adverse effect on operating safety yet has <u>NO</u> potential effective maintenance requirement, then this condition must be reported to the managers of the project for resolution through some form of redesign action.

NO answers. There is no direct adverse effect on operating safety and no mandatory scheduled maintenance requirement is required to be listed.

Question 4: Is the function hidden from the viewpoint of the flight crew (or operating personnel)?

For YES answers, periodic inspections, ground tests or shop tests may be required as a means to ensure that there is a high probability of the hidden function being available when required. Examples include such items as tail bumper structures, the structure provided for wheels-up landings, fire detection temperature probes, certain high pressure hot air valves, thermal blanketing material. At least one scheduled maintenance requirement must be listed for each YES answer. Scheduled maintenance requirements as a result of YES answers to the hidden function question shall be listed on MPA Worksheet 4 block (i) and will become part of either the hardtime or on-condition maintenance process.

For NO answers, no scheduled maintenance requirements are required.

Question 5: Is there an adverse relationship between age and reliability?

This question must be answered for the item as an entity. To answer this question, it is necessary to review the predicted failure rates on MPA Worksheet 3.

For YES answers, the resultant potential effective scheduled maintenance requirements shall be documented on MPA Worksheet 4 block (i) and will be candidates for the hardtime maintenance process. YES answers are expected for structures, but only in regards to the fact that the total time envelope (structural service life) is very large. However, in case of subsystems/ components, there are structural cells or assemblies that when replaced will in fact "renew" or preserve the life of the structure. Equipment/components periodic overhaul or throwaway replacement may be an effective way of controlling the corrective maintenance cost of either the end item (in terms of availability in a mission sense) or of the equipment/component.

For NO answers, scheduled overhaul/replacement cannot protect or ensure operational reliability. These items should be operated without scheduled overhaul/replacement requirements. Many electronic and some electromechanical items will qualify NO. This is due to the fact that the overall measures of reliability such as removal rate of these complex assemblies/components are not usually a function of age. In this event, when reliability must be improved, engineering design action is the only means available.

4.3.1.3 Structural Significant Items (SSI) Analysis Procedures

When analyzing structural elements which are potential MSI's, it is mandatory that their characteristics of stress, corrosion, cracking and fatigue be rated in accordance with the Figure 5 Structural Analysis Rating Sheet and documented on MPA Worksheet 10. A NO answer to all the Group 5 Questions is unlikely for fixed structure, but the failure interval for this type of hardware is usually so long that frequent repetitious inspections on all items are usually not cost effective. The structure criticality rating (R) is determined for all SSI's in accordance with the five factors on Figure 5 and is used to determine a relative level of structural integrity in order to establish the need for and frequency of SSI inspections. The five factors are subjectively rated from 1 to 4. The overall rating is established through engineering judgement from the five ratings. The results of this analysis are documented on MPA Worksheet 10 in block (e). Refer to Figure 5, MPA Worksheet 10, and the following explanation in the development of the structure criticality rating:

(1) FATIGUE RESISTANCE. Indicate the fatigue resistance relative to the expected fatigue life (fatigue design goal) of the aircraft. Data to arrive at this rating should be drawn from aircraft stress reports, structural life studies, service bulletins, technical directives, engineering investigations, etc.

RATING		
1	(a)	Small margin above design goal.
2	(b)	Fair margin above design goal.
3	(c)	Considerable margin above design goal.
4	(d)	High margin above design goal.

(2) CORROSION RESISTANCE. Indicate the corrosion resistance of the SSI considering environment, material, and protective methods. This evaluation shall include all types of corrosion, including stress corrosion. Data to arrive at this rating should be available from aircraft structural historical data.

FATIGUE RESISTANCE	AN INDICATION OF THE FATIGUE RESISTANCE OF THE ITEM RELATIVE TO THE FATIGUE DESIGN GOAL FOR THE OVERALL AIRPLANE			
	SMALL MARGIN ABOVE DESIGN GOAL	FAIR MARGIN ABOVE DESIGN GOAL	CONSIDERABLE MARGIN ABOVE DESIGN GOAL	HIGH MARGIN ABOVE DESIGN GOAL
CORROSION RESISTANCE (INCL. STRESS CORROSION)	AN INDICATION OF THE RELATIVE CORROSION RESISTANCE OF THE ITEM. CONSIDERING BOTH EXPOSURE AND PROTECTION			
	SMALL MARGIN OF RESISTANCE	FAIR MARGIN OF RESISTANCE	CONSIDERABLE MARGIN OF RESISTANCE	HIGHEST MARGIN OF RESISTANCE
CRACK PROPAGATION RESISTANCE	AN INDICATION OF THE RELATIVE ABILITY OF THE MATERIAL USED TO RESIST PROPAGATION OF CRACKS			
	LEAST MARGIN OF RESISTANCE (HI HEAT TREAT STEEL)	FAIR MARGIN OF RESISTANCE (7000 SERIES ALUM)	CONSIDERABLE MARGIN OF RESISTANCE (TITANIUM)	HIGHEST MARGIN OF RESISTANCE (2000 SERIES ALUM)
DEGREE OF REDUNDANCY	AN INDICATION OF THE DEGREE TO WHICH THE ITEM IS BACKED UP BY REDUNDANT STRUCTURE			
	SMALL	________	________	________
FATIGUE TEST RATING	WILL THE LOADS APPLIED TO THE ITEM IN THE FULL SCALE FATIGUE TEST PROPERLY REPRESENT LOADS PREDICTED FOR SERVICE USAGE?			
	NO	________	________	________
STRUCTURE CRITICALITY RATING	A RATING WHICH CONSIDERS ALL THE ABOVE RATINGS AND COMBINES THEM BY JUDGEMENT INTO A SINGLE OVERALL RATING WHICH REPRESENTS LEVEL OF THE STRUCTURAL INTEGRITY OF THE ITEM			
	1	2	3	4

FIGURE 5. STRUCTURAL ANALYSIS RATING SHEET

RATING

1 (a) Small margin of resistance.

2 (b) Fair margin of resistance.

3 (c) Considerable margin of resistance.

4 (d) High margin of resistance.

(3) CRACK PROPAGATION RESISTANCE. Provide an indication of the relative ability of the SSI both in terms of material and configuration to resist the propagation of cracks. In general, high heat-treated steels have a higher rate of crack growth than the softer aluminum alloys. Geometrical changes tending to act as crack-stoppers must also be considered.

RATING

1 (a) Least margin of resistance (high heat-treated steels).

2 (b) Fair margin of resistance (7000 series aluminum).

3 (c) Considerable margin of resistance (titanium).

4 (d) Highest margin of resistance (2000 series aluminum).

(4) DEGREE OF REDUNDANCY. Indicate the degree to which the SSI is backed up by redundant structure or alternate load paths. A small degree is rated "1"; a high degree is rated "4".

(5) FATIGUE TEST RATING. Indicate whether the SSI was subject to a fatigue test (i.e., YES or NO). Information is available in fatigue test reports for aircraft under analysis. Assign a rating.

(6) OVERALL RATING. Consider the five previous ratings and combine them by engineering judgement into a single overall rating which represents the level of structural integrity of the SSI. Normally, the fatigue or corrosion resistance rating or the lowest rating will determine the overall criticality rating.

The analysis now documents the capability of determining a failure condition of an SSI externally, in block (f).

Enter the appropriate categorization letter that indicates whether an internal structure failure can be detected externally. An external indication could be a crack, wrinkled skin, missing or loose fasteners.

(1) Category A - Indicates no external detectability of internal failures.

(2) Category B - Indicates external detectability of internal failures.

Based on the above data a determination is made regarding the structural examinations required, what type of examination (sampling and/or total fleet inspection) and the frequency of the examinations. Guidelines to these determinations are given on Figure 6. Enter YES or NO for the structural examination required on the SSI in block (g). Describe the inspections to be performed on this SSI for both Internal Sampling and External Inspections and their frequency in block (h) as follows:

(1) INTERNAL SAMPLING INSPECTION. Enter details of the inspection task. Do not define how to perform the inspection or tools required except if Non-Destructive Test (NDT) procedures are used; in this case, the type of NDT procedure/process should be identified (i.e., x-ray, eddy-current, dye penetrant, etc.).

(2) FREQ. Enter the frequency at which the task should be performed in terms of the depot interval.

(3) EXTERNAL INSPECTION. Refer to (1) above.

(4) FREQ. Enter the frequency at which the task should be performed in terms of flight hours.

The SSI's have now been determined from the potential MSI listing and the maintenance requirements TO BE DONE have been established along with the requirement frequency and the Non-Destructive Test equipment identified. Document these scheduled maintenance requirements TO BE DONE on MPA Worksheet 5 block (e), their frequency in block (f) and if the maintenance level has been determined list this in block (g). List the corresponding potential MSI sequence number in block (d) of MPA Worksheet 5 in line with the scheduled maintenance requirements TO BE DONE on that item. Now go back to MPA Worksheet 1, block (k) and place a YES in the "SCHED" column for each potential MSI having a scheduled maintenance requirement TO BE DONE.

CRITICALITY RATING	EXTERNAL DETECTABILITY CATEGORY	DESCRIPTION	INTERNAL SAMPLE EACH SDLM	EXTERNAL INSPECTION FREQUENCY
1	A	CRITICAL STRUCTURE NO EXTERNAL DETECTABILITY	1 in 5 (20%)	----
1	B	CRITICAL STRUCTURE EXTERNAL DETECTABILITY	1 in 7 (14%)	4 PC*
2	A	ESSENTIAL STRUCTURE NO EXTERNAL DETECTABILITY	1 in 7 (14%)	----
2	B	ESSENTIAL STRUCTURE EXTERNAL DETECTABILITY	1 in 10 (10%)	6 PC
3	A	MINOR STRUCTURE NO EXTERNAL DETECTABILITY	1 in 10 (10%)	----
3	B	MINOR STRUCTURE EXTERNAL DETECTABILITY	1 in 20 (5%)	8 PC
4	-	SECONDARY STRUCTURE	1 in 20 (5%)	8 PC

*PC - Phased Cycle for Aircraft

FIGURE 6 Sample SSI Inspection Results based on the Structure Criticality Rating and External Detectability Category.

4.3.1.5 Finalizing the Non SSI Scheduled Maintenance Requirements Resulting from Group 5 Questions.

Scheduled maintenance requirements that must be done. The second phase of the scheduled maintenance requirements determination (Figure 4 Part B) is to identify those scheduled maintenance requirements that MUST be done. The results of this process shall be documented on MPA Worksheet 5 block (e) (Schedule Maintenance Requirements TO BE DONE). This phase will analyze those requirements documented on MPA Worksheet 4 as a result of YES answers to Question 3 (Does the failure mode have a direct adverse effect on operating safety?) and Question 4 (Is the function hidden from the viewpoint of the flight crew or operating personnel?) of Group 5 Questions. Specific scheduled maintenance requirements and their respective accomplishment intervals are required as a result of YES answers. For the direct adverse effect on operating safety question, an evaluation must be made using those potentially effective scheduled maintenance requirements listed on MPA Worksheet 4. If the item has detectable characteristics but these characteristics are subtle with relationship to other installed items, it would be unwise to generate an on-condition task. Likewise, it would be unwise to generate a hardtime requirement for an item whose characteristics are easily detectable prior to failure unless the hardtime requirement was economically justifiable as well.

At least one scheduled maintenance requirement must be listed for each failure mode that has a direct adverse effect on operating safety. It is possible that one scheduled maintenance requirement will satisfy the demands of multiple failure modes and their respective time limits. If this case is used, it will be necessary to list the number of each applicable failure mode.

Document the scheduled maintenance requirements on MPA Worksheet 5, block (e). Analyze the failure characteristics to determine if a on-condition or hardtime requirement is to be established.

List the corresponding sequence number of the potential MSI having YES answers to Questions 3 and 4 on MPA Worksheet 5, block (d). In addition, list the scheduled maintenance requirements TO BE DONE resulting from YES answers to Question 1 (Is the reduction in failure resistance detectable by routine flight crew (or operating personnel) monitoring?) in block (e) of MPA Worksheet 5 and the corresponding potential MSI sequence number in block (d) of MPA Worksheet 5.

Now go back to MPA Worksheet 1 block (k) and place a YES in the "SCHED" column for each potential MSI having YES answers to Questions 1, 3 and 4.

4.3.1.4 Scheduled Maintenance Requirements That Should Be Done Group 3 Questions

The final process in the determination of the scheduled maintenance requirements is the evaluation of the remainder of the potentially effective scheduled maintenance requirements (on MPA Worksheet 4) to determine those requirements that SHOULD be accomplished (Figure 4, Part C). The only potential effective scheduled maintenance requirements to be considered are those non-SSI potential MSIs having YES answers to Group 5 Questions 2 and 5. The key considerations provided in this section are economics and mission accomplishment. The procedure in answering the questions changes from that of previous steps. In this step, several questions are asked almost concurrently to arrive at the answer. Determinations of failure zone and potential detectability (exhibited characteristics and installation environment) must be made prior to asking any of the questions. Use MPA Worksheet 4, block (g), to document the following questions:

Question 1: Does real and applicable data show the desirability of a scheduled task?

There are two conditions that establish the criteria for the use of real and applicable data. The first one is prior knowledge from other aircraft/equipment that the scheduled maintenance tasks had substantial evidence of being truly effective and economically worthwhile; the other one is an item configuration comparison of the old and new, as tempered by the installation, to conclude that the scheduled maintenance requirement will or will not be equally effective for the new item.

For YES answers, enter the potentially effective scheduled maintenance requirement on MPA Worksheet 5, block (e), as a maintenance requirement TO BE DONE. List the corresponding potential MSI sequence number in MPA Worksheet 5, block (d) and place a YES in the SCHED column of block (k) MPA Worksheet 1 for the corresponding potential MSI.

The NO answers indicate that the real and applicable data shows the non-desirability of a scheduled maintenance requirement; however, before a disposition can be made on these items, the next question must be asked.

Question 2: Does the failure prevent mission accomplishment?

A YES answer requires consideration of assurance of function for items in the insurance category where there is a low probability of detection. A scheduled requirement is listed or omitted based on the rest of this analysis.

For NO answers no scheduled maintenance requirements are listed.

It is necessary to ask the next question prior to final determination.

Question 3: Is the elapsed time for correction of the failure less than 1/2 hour?

The answer to this question envolves around the capability of the organizational maintenance to troubleshoot, isolate, and repair the failure with the 1/2 hour elapsed time.

For YES answers, the potentially beneficial maintenance requirements should NOT be included in the scheduled maintenance program.

For NO answers utilize the following discussion:

Recapping the results of answering the three questions, disposition is made of all potential maintenance requirements except those having a NO answer to Question 1, a YES answer to Question 2 and a NO answer to Question 3. Basically the analysis has arrived at the judgement point. It may be beneficial to await the generation of corrective maintenance requirements before making the judgement. Make a judgement to include or exclude maintenance requirements for NO-YES-NO answers to these questions.

From an engineering standpoint, the scheduled maintenance requirements have been determined and are identified on MPA Worksheet 5. Now go back and complete the <u>scheduled</u> column of MPA Worksheet 1, block (h) so that the column reflects YES answers for all potential MSI which have scheduled maintenance requirements on MPA Worksheet 5, block (e).

4.3.1.6 <u>Scheduled Maintenance Requirements Task Analysis MPA Worksheet</u>.

It is now necessary to determine what resources are required to perform the scheduled maintenance requirements, at which maintenance level and when they should be accomplished. These decisions are made based upon the scheduled maintenance task analysis logic flow diagram to be generated on MPA Worksheet 6 and from the predicted failure rate data on MPA Worksheet 3.

Develop the task analysis as follows for each scheduled maintenance requirement listed on MPA Worksheet 5, block (e).

A separate MPA Worksheet 6 is required for each scheduled maintenance requirement. In the <u>preparation block</u> of MPA Worksheet 6, list the tasks required to be accomplished in order to gain access to the area to be inspected. List outside of the block the requirements for services such as: hydraulic pressure, electrical power, engine operation, etc.; the ground support equipment required; the estimated elapsed time to gain access and the estimated number of personnel required to accomplish the preparation.

In the <u>process</u> block list the tasks required to accomplish the inspection. List outside of the block the inspection limits for rejection and/or acceptance, the service required, the ground support equipment, the estimated elapsed time to accomplish, and the number of personnel required to accomplish the inspection.

In the <u>secure</u> block list the tasks required to validate the results of the inspection and those required to close up the area. List outside the block the tests required for inspection validity, the services required, ground support equipment, the estimated elapsed time to accomplish and the number of personnel required to accomplish the secure portion of the inspection.

Determine the requirement frequency from the predicted failure rate data on MPA Worksheet 3. The optimum inspection interval will be just prior to the steepest rise in the failure rate curve.

Based on the data on MPA Worksheets 3 and 5 and a knowledge of the Navy maintenance level capability and the need for readiness, the scheduled maintenance level may be determined. One restriction is placed on organizational level maintenance requirements which allows no single or group of scheduled maintenance requirements to exceed a total of eight (8) hours elapsed maintenance time. Therefore, any scheduled maintenance requirement consuming hours of elapsed time must be scrutinized and modified if possible (or cause redesign of the equipment).

4.3.1.7 <u>Finalizing MPA Worksheet 5 - Scheduled Maintenance Requirements</u>

Blocks (f), (g) and (h) of MPA Worksheet 5 may now be completed for each scheduled maintenance requirement TO BE DONE based on the information on MPA Worksheet 6.

This ends the SCHEDULED MAINTENANCE GROUP analysis portion of the MPA.

4.4 <u>MPA Corrective Maintenance Group Worksheet Completion Direction</u>

4.4.1 <u>MPA Worksheet 7 - Failure Causes and Restorative Action</u>

The corrective maintenance requirements consist of specific repair actions that are necessary to restore an item to an acceptable condition after malfunction. Prior to making the decision whether an item will be repaired or discarded, where it will be repaired or discarded and what is needed to repair the item, it is first necessary to determine the potential repair action content. Each failure has not only an effect connected with it (as listed on MPA Worksheet 2) but also a cause. The cause is normally connected with parts malfunction but some instances could be corrected by adjustment, servicing and/or flushing (in the case of hydraulic fluid contamination). On MPA Worksheet 7 relist all potential MSI sequence numbers in block (d) that are in block (d) of MPA Worksheet 2. Relist the failure mode numbers in block (e). Failure mode numbers are listed on MPA Worksheet 2. Briefly describe the causes associated with each failure mode in block (f) of MPA Worksheet 7. Individual part failures are NOT to be listed but rather list general causes of repairable item malfunctions, such as circuit board XXX-XX not providing proper signal, pressure control valve inoperative, pressure gauge inoperative, hydraulic cylinder cracked, etc. Do not list consumable failures such as: Capacitor open, bolt broken, wire parted, gear stripped. For each cause listed in block (f), list the restorative action required to correct the failure mode in block (g).

Assign a restorative action number for each cause when more than one type of restorative action may correct the failure cause, such as (1) adjust voltage, (2) repair amplifier, (3) replace circuit board XXX-XX. It is again important NOT to list piece part restorative action; the analysis must be made at the potential MSI level and general failure causes/restorative actions listed in order to avoid this area of the analysis becoming a parts breakdown. Estimate the probability of this cause occurring for each listed action in block (h) in terms of percent of the subsystem/component (WRA) total failure rate. The WRA level is that level having MPA Worksheet 3 data.

4.4.2 MPA Worksheet 8 - GSE/SM&R Code Development

The next step involves the determination of the repair level (Organizational, Intermediate or Depot) and the corresponding GSE (ground support equipment) required to effect the repair action. Before these determinations can be made, the complexities of fault isolation and removal/replacement of the items must be accomplished, because in many cases the repair of items could be placed at a maintenance level that cannot determine where the fault is or does not have the capability to gain access to the faulty area. On MPA Worksheet 8 relist the potential MSI sequence numbers in block (d). List the Failure Mode numbers from MPA Worksheet 7 in block (e). The procedures, skills and GSE necessary to fault isolate to the potential MSI (for each failure mode) must now be considered and a determination made regarding the lowest maintenance level that can determine the faulty item(s). If the fault can be isolated only to several items at the organizational level then this capability shall be listed in block (f) because it is desirable to accomplish as much fault isolation at the organizational level as possible in order to avoid taking the aircraft out of service. The GSE is to be listed by functional identity and part number. If the required GSE is not available and therefore does not have a part number then the functional identity is all that is required. Next, the lowest maintenance level capable of removing and replacing the item and/or accomplishing check and test of the item and the GSE required to accomplish either action is identified in block (g) of MPA Worksheet 8. Use R/R to identify remove/replace actions and C/T to identify check/test actions in block (g). The determination of the maintenance level authorized to restore the item to an acceptable condition requires the consideration of fault isolation, remove/replace, check/test, aircraft down time and economics. Blocks (f) and (g) give insight into all these considerations except economics. The Level of Repair Analysis (LOR) procedures as per MIL-STD-1390A are to be utilized to determine the economics of restorative action at each maintenance level. Appendix A of MIL-STD-1390A applies to Avionic Equipments and Appendix A-1 applies to Gas Turbine Engines. From an economic standpoint the LOR model evaluates thirteen individual cost elements associated with the logistic support of each significant item. These costs are summed for each maintenance alternative and result in a total life cycle logistics cost. The maintenance alternatives considered include repair at intermediate, repair at depot and discard.

The intermediate level may be split into as much as three distinct groups of maintenance requirements for a given significant item under the NAVAIR "Three Degree Intermediate Level Maintenance Program". This program was initially implemented for gas turbine engines under NAVAIRINST 13700.6A and has since been expanded to all hardware, when applicable. The avionics LOR model is being modified to provide LOR data for two degrees. If degrees of intermediate repair capability are to be established then use I-1 for first degree (most repair capability), I-2 for second degree (less than I-1 capability) and I-3 for third degree (less than I-1 and I-2 capability). There is no requirement to break out intermediate level into degrees; the decision <u>to</u> or <u>not to</u> do so is to be based on fault isolation, remove/replace capability, economics and minimum aircraft downtime.

4.4.3 MPA Worksheet 9 - Economic Level of Repair Analysis Results

The LOR is performed on those potential MSI's listed in the LOR candidate list. For each potential MSI on which a LOR was performed list the sequence number in block (d) of MPA Worksheet 9. Block (e) contains the predicted failure rate derived from MPA Worksheet 3 for WRA potential MSI's and from MPA Worksheet 3 and the predicted cause percent occurrance data on MPA Worksheet 7 for potential MSI's below the WRA level. The estimated purchase cost of the potential MSI is listed in block (f) and the predicted removal rate in flight hours is listed in block (g). The results of the LOR in terms of total life cycle logistics cost for the four maintenance alternatives are placed in block (h).

4.4.4. Now all the data is available to determine if the potential MSI should be repaired or discarded. The decision is based on the fault isolation capability, the remove and replace and check/test capability, the consideration of minimum aircraft downtime and the total life cycle logistics cost. Record the REPAIR or DISCARD decision on MPA Worksheet 1 in the "CORR" column of block (k). Place a YES for each repairable significant item and a NO for each discard significant item. For those MSI's determined to be repairable list the maintenance level authorized and the GSE required to restore the item to an acceptable ready for service condition on MPA Worksheet 8, block (h).

This ends the CORRECTIVE MAINTENANCE GROUP analysis portion of the MPA.

Appendix II contains all of the MPA Worksheets.

4.5 Maintenance Plan Generation

The data is now available to generate and justify a Maintenance Plan for the system. Appendix III contains the Maintenance Plan format and a description of the entries required within each block. The following discussion describes the procedure to be used to document a Maintenance Plan from a completed MPA.

Fill in the Maintenance Plan heading information as described in Appendix III for all three parts: General Considerations, Repair Capability and Maintenance Requirements.

Refer to the annotated MPA worksheets in Appendix IV in tracking the following direction. Describe Maintenance Plan Subject Hardware Design as the first entry in the narrative block of Part I (General Considerations). This data although not specifically generated on MPA worksheets was the basis of the entire MPA and therefore readily available. Data on MPA Worksheet 1, blocks (i) and (j) provide pertinent design and function information.

List the corrective significant items WUC/LSACN, part number and nomenclature on Part II of the Maintenance Plan. These are potential MSI having YES answers in the "CORR" column of MPA Worksheet 1, block (k). This identifies all the repairable components within the system under analysis.

Fill in the maintenance requirements data on Part III of the Maintenance Plan for the MPA determined scheduled maintenance requirements. This data is provided on MPA Worksheet 5. Since the Part III Maintenance Plan sheet does not contain the significant item nomenclature, part number and WUC/LSACN data on MPA Worksheet 5, the maintenance requirements information on Part III of the Maintenance Plan must, in the word description, contain this information. The arrangement is this way to enable the maintenance requirements to be grouped by maintenance level and to enable combinations to be covered by collective action. List the scheduled maintenance requirements for organizational level first, then intermediate level, and finally depot level. Provide the interval and GSE information for each scheduled maintenance requirement listed (from MPA Worksheet 5).

Following the scheduled maintenance requirements data on Part III of the Maintenance Plan, list the corrective maintenance requirements beginning with organizational level, then intermediate and finally depot. The corrective maintenance requirements are determined from block (g) (Restorative Action) on MPA Worksheet 7. Again each maintenance requirement must contain the nomenclature, part number, and WUC/LSACN data within the word description.

The maintenance level and GSE requirements for the corrective maintenance requirements are listed on MPA Worksheet 8, block (h). The interval column is left blank for each corrective maintenance requirement. This completes Part III.

Now the data is available to determine the SM&R (Source, Maintenance and Recoverability) Codes on Part II for each item listed. NAVAIRINST 4423.3A describes the meaning of each position of the code. The first two represent the source of the item in question (basically, <u>make</u> or <u>buy</u>), the next position represents the removal/replacement maintenance level. This information is on MPA Worksheet 8, block (g). The next position (4th) represents the maintenance level authorized to repair the item in question. This information is on MPA Worksheet 8, block (h) and also on Part III of the Maintenance Plan. This position has caused concern when the item in question has some assemblies repairable at intermediate and some at depot level. When this is the case, code the item fourth position intermediate and code the assemblies fourth position intermediate or depot as determined in the MPA. This will not solve the item coding problem when viewed alone, but when the repairable assemblies within the item are coded, the repair program will become clear. The fifth position denotes the maintenance level authorized to condemn the item (no repair). Because of supply policy, the code should be depot for all items costing $5,000 or more. For items under $5,000, the most appropriate maintenance level may be used. It should be noted that the code structure allows for only one maintenance level to repair a given item except in the case described above. This procedure must be adhered to, and the Maintenance Plan must not establish complete repair at two maintenance levels for an item.

The determination of the MRF (Maintenance Replacement Factor) and the RFP (Rotable Pool Factor) are based on the failure rate development on MPA Worksheet 3, the maintenance level of the restorative actions as listed on MPA Worksheet 8, block (h) and the predicted percent (%) occurrence of restorative actions below the WRA level as listed on MPA Worksheet 7, block (h). The MRF and RPF are based on flight hours as are the data on MPA Worksheet 3. The MRF represents the rate of the items return to depot in relation to the flying hour program (number of BCM actions per 100 flying hours). It aids the PSICP (Program Support Inventory Control Point) to determine how many items will be required for a given flying hour program. The RFP represents the rate of the item's repair at intermediate level in relation to the flying hour program (number of I-level repairs per 100 flying hours) and is another input into the PSICP's determination of quantity required. Picture an item in the aircraft which malfunctions at a predictable rate. The item is removed and sent to intermediate level for repair action. The intermediate level repairs some and sends some to depot because the area of failure is not within the capacity of the intermediate level (as determined by the Maintenance Plan). Depot fixes those received. Then this item has both a MFR and a RPF. If intermediate was authorized no repair on this item, then the RPF would be zero or N/A. Likewise, if depot was not authorized repair, the MRF would be zero or N/A. Develop the MRF's and RPF's from the failure rate development data on MPA Worksheet 3 and the predicted percent (%) occurrence below the WRA level on MPA Worksheet 7, block (h). Ensure on Part III of the Maintenance Plan that the restorative action level is depot for MRF items and intermediate for RPF items or, if an item has some depot and some intermediate restorative actions, then both a MRF and RPF is required.

The depot recovery factor is an estimate of the percentage of reworked items restored during depot processing. As an example, if 100 items were inducted into depot and 98 were restored the depot recovery factor would be .98. Conversely a .02 attrition factor occurs on this item at depot. Normally this depot recovery factor will be close to 1.0 but some sensitive/fragile designs may have a significantly lower probability of depot repair. A lower depot recovery factor alerts the PSICP not to expect depot to supply a high quantity of items and to supplement the requirement with new buys. Estimate the recovery factors from knowledge of the design and the difficulty of accomplishing the restorative action. For items with no depot repair, Part II of the Maintenance Plan under Depot Recovery Factor will be left blank.

The system recovery factor is the same as the depot recovery factor but expanded to reflect the losses throughout the entire repair process. In other words, the system recovery factor represents the percentage of the total items restored based on the total items removed. All repairable items will have a system recovery factor. Estimate the system recovery factor from knowledge of the design and the difficulty of accomplishing the restorative action. This completes Part II of the Maintenance Plan.

Based on the documentation on Parts II and III of the Maintenance Plan and the MPA, the Maintenance Plan Summary is documented in Part I of the Maintenance Plan following the design description paragraphs. In this paragraph, provide any significant comments pertinent to the support of the Maintenance Plan Subject Hardware not specifically presented elsewhere in the plan as well as a summary of the support plan.

Following the Maintenance Plan Summary paragraph, provide the Plan Rationale in a narrative paragraph. The rationale must provide the <u>why</u> of the plan and the basis for the <u>why</u>. The MPA should provide this data in terms of safety, economics and availability. This completes the Maintenance Plan.

5.0 MPA WORKSHEET DATA USES OTHER THAN MAINTENANCE PLAN GENERATION

The data contained on the completed MPA Worksheets are pertinent to other efforts being accomplished within the development program. Appendix IV contains the MPA Worksheets annotated in two ways:

1. The worksheet data as inputs to other LOGISTIC ELEMENTS.

2. The worksheet data as inputs to other efforts within the development program.

This information in no way represents all the uses of this data but it has been presented to enable thought on other uses of the data.

APPENDIX I

MAINTENANCE PLAN CANDIDATES

Since the MSG-2 logic is applied from a functional system standpoint, the breakdown of the weapon system into functional systems is necessary. Maintenance Plans are to be written for each functional system. To generate the Maintenance Plan candidate list, review the following functional system/subsystem list and delete systems/subsystems not under consideration and/or add any system/subsystem under consideration but not included in the listing.

1. <u>ELECTRICAL POWER SYSTEM MAINTENANCE PLAN</u>: Those electrical units and components which generate, control, and supply AC and/or DC electrical power for other systems, including generators and relays, inverters, batteries, etc., through the secondary busses. Also includes common electrical items such as wiring, switches, connectors, etc.

<u>SUBSYSTEMS</u>

GENERATOR DRIVE: Mechanical devices that drive the generators at a desired RPM. Includes items such as oil system, connecting devices, indicating and warning systems for the drive, etc.

AC GENERATION: That portion of the system used to generate, regulate, control, and indicate AC electrical power. Includes items such as inverters, AC generators/alternators, control and regulating components, indicating systems, etc., all wiring to but not including main busses.

DC GENERATION: That portion of the system used to generate, regulate, control, and indicate DC electrical power. Includes items such as generators/alternators, transformers, rectifiers, batteries, control and regulating components, indicating systems, etc., all wiring to but not including the main busses.

EXTERNAL POWER: That portion of the system within the aircraft which connects external electrical power to the aircraft's electrical system. Includes items such as relays, receptacles, switches, wiring, warning lights, etc.

ELECTRICAL LOAD DISTRIBUTION: That portion of the system which provides for connection of AC or DC power to using systems. Includes items such AC and DC main and secondary busses, main system circuit breakers, power systems devices, etc.

2. <u>HYDRAULIC POWER SYSTEM MAINTENANCE PLAN</u>: Those units and components which furnish hydraulic fluid under pressure (includes pumps, regulators, lines, valves, etc.) to a common point (manifold) for redistribution to other defined systems.

<u>SUBSYSTEMS</u>

MAIN: That portion of the system which is used to store and deliver hydraulic fluid to using systems. Includes items such as tanks, accumulators, valves, pumps, levers, switches, cables, plumbing, wiring, external connectors, etc.

AUXILIARY: That portion of the system which is classified as auxiliary, emergency, or standby and which is used to supplement or take the place of the main hydraulic system. Includes items such as tanks and accumulators which are separate from the main system, auxiliary pumps, valves, plumbing, wiring, warning systems, etc.

INDICATING: That portion of the system which is used to indicate the quantity, temperature, and pressure of the hydraulic fluid. Includes items such as transmitters, indicators, wiring, warning systems, etc.

3. <u>PNEUMATIC SYSTEM MAINTENANCE PLAN</u>: Those units and components (ducts and valves) which deliver compressed air from a power source to its connecting points for such other systems as air conditioning, pressurization, de-icing, etc.

<u>SUBSYSTEMS</u>

DISTRIBUTION: That portion of the system which is used to distribute high or low pressure air to using systems. Includes items such as ducts, valves, actuators, heat exchangers, controls, etc. Does not include the supply valves to the using systems.

INDICATING: That portion of the system which is used to indicate temperature and pressure of the pneumatic system. Includes temperature and pressure warning systems.

4. <u>VACUUM SYSTEM MAINTENANCE PLAN</u>: Those units and components used to generate, deliver, and regulate negative air pressure, including, pumps, regulators, lines, etc., through and including the manifold.

SUBSYSTEMS

DISTRIBUTION: That portion of the system which is used to distribute negative pressure air to using systems.

INDICATING: That portion of the system which is used to indicate pressure. Includes pressure warning systems.

5. AIRBORNE AUXILIARY POWER SYSTEM MAINTENANCE PLAN: Those airborne power plants (engines) which are installed on the aircraft for the purpose of generating and supplying a single type or combination of auxiliary electric, hydraulic, pneumatic, or other power. Includes power and drive section, fuel, ignition, and control systems; also wiring, indicators, plumbing, valves, and ducts up to the power unit.

6. EMERGENCY POWER SYSTEM MAINTENANCE PLAN:

SUBSYSTEMS

RAM AIR TURBINE: Those turbine units capable of being extended into and driven by the airstream.

Controlling: Mechanical, hydraulic, and electrical systems used for extension and retraction of the Ram Air Turbine. Includes extension and retraction cylinders, control valves, reservoirs, handles, cables, pulleys, springs, switches, warning lights, etc.

Hydraulic Power Units: Includes hydraulic pumps, regulator valves, bypass valves, control valves, pressure switches, pressure transmitters, etc.

Electrical Power Units: Includes generators, voltage regulators, transformer rectifiers, transfer relays, wiring, etc.

HYDRAULIC-DRIVEN EMERGENCY ELECTRICAL POWER UNITS: Includes motor generators, hydraulic motors, motor generator regulators, transfer relays, undervoltage relays, bus control relays, wiring, etc.

HAND-DRIVEN EMERGENCY HYDRAULIC POWER SYSTEMS: Includes reservoirs, hand pumps, filters, relief valves, check valves, etc.

7. <u>AIR CONDITIONING SYSTEM MAINTENANCE PLAN:</u> Those units and components which furnish a means of pressuring, heating, cooling, moisture controlling, filtering, and treating the air used to ventilate the areas of the fuselage within the pressure seals. Includes cabin supercharger, equipment cooling, heater, heater fuel system, expansion turbine, valves, scoops, ducts, etc.

<u>SUBSYSTEMS</u>

COMPRESSION: That portion of the system and its controls which supply compressed air to the cabin. Includes items such as controls and indicating systems related to the compressors, wiring, etc.

DISTRIBUTION: That portion of the system used to induct and distribute air. Includes equipment rack cooling system and items such as blowers, scoops, ducting, inlets, check valves, wiring, etc.

PRESSURIZATION CONTROL: That portion of the system used to control the pressure within the fuselage. Includes items such as control valves, relief valves, indicators, switches, amplifiers, wiring, etc.

HEATING: That portion of the system and its controls which supply heated air to the cabin. Includes items such as heater units, fuel system and control ignition, indicating systems related to heater operation, wiring, etc.

COOLING: That portion of the system and its controls which supply cooled air to the cabin. Includes items such as the cooling units, indicating systems related to the cooler operation, wiring, etc.

TEMPERATURE CONTROL: That portion of the system used to control the temperature of the air within the cabin. Includes such items as control valves, thermal sensing devices, switches, indicators, amplifiers, wiring, etc.

MOISTURE/AIR CONTAMINANT CONTROL: That portion of the system used to control moisture in the air, to control ozone concentrations, to filter radioactive debris from conditioned air, and to treat the air with deodorizers and insecticides, etc.

8. ICE AND RAIN PROTECTION SYSTEM MAINTENANCE PLAN: Those units and components which provide a means of preventing or disposing of formations of ice and rain on various parts of the aircraft. Includes alcohol pump, valves, tanks, propeller/rotor anti-icing system, wing heaters, water line heaters, pitot heaters, scoop heaters, windshield wipers, and the electrical and heated air portion of windshield ice control.

SUBSYSTEMS

AIRFOIL: That portion of the system which is used to eliminate or prevent the formation of ice on all airfoil surfaces. Includes wings, airfoil sections of the empennage, and pylons.

AIR INTAKES: That portion of the system which is used to eliminate or prevent the formation of ice in or around air intakes. Includes power plant cowling anti-icing.

PITOT STATIC: That portion of the system which is used to eliminate or prevent the formation of ice on the pitot and static systems.

WINDOWS AND WINDSHIELDS: That portion of the system which is used to eliminate or prevent the formation of ice, frost, or rain on the windows and windshields.

ANTENNAS AND RADOMES: That portion of the system which is used to eliminate or prevent the formation of ice on antennas and radomes.

PROPELLERS/ROTORS: That portion of the system which is used to eliminate or prevent formation of ice on propellers or rotors. Includes all components up to but not including rotating assembly.

WATER LINES: That portion of the system which is used to prevent the formation of ice in water supply and drain lines.

DETECTION: That portion of the system which is used to detect and indicate the formation of ice.

9. **OXYGEN SYSTEM MAINTENANCE PLAN**: Those units and components which store, regulate and deliver oxygen to the passengers and crew including bottles, relief valves, shutoff valves, outlets, regulators, masks, walk-around bottles, etc.

SUBSYSTEMS

CREW: That portion of the system which furnishes oxygen to the crew.

PASSENGER: That portion of the system which furnishes oxygen to the passengers.

PORTABLE: That portion of the system which has an independent oxygen supply and which can be transported about the airplane.

10. **FIRE PROTECTION SYSTEM MAINTENANCE PLAN**: Those fixed and portable units and components which detect and indicate fire or smoke and distribute fire extinguishing agent to all protected areas of the aircraft, including bottles, valves, tubing, etc.

SUBSYSTEMS

DETECTION: That portion of the system which is used to sense and indicate the presence of overheat, smoke, or fire.

EXTINGUISHING: That portion of those fixed or portable systems which is used to extinguish fire.

EXPLOSION SUPPRESSION: That portion of the system which is used to sense, indicate, and extinguish a flame propagating into the fuel vent or scoop to prevent an explosion in the fuel system.

11. **LIGHTING SYSTEM MAINTENANCE PLAN**: Those units and components which provide for external and internal illumination such as landing lights, taxi lights, position lights, rotating lights, ice lights, master warning lights, passenger reading and cabin dome lights, etc. Includes bulbs, light fixtures, switches, and wiring. Does not include warning lights for individual systems.

SUBSYSTEMS

FLIGHT COMPARTMENT/COCKPIT: The lighting subsystems in the compartment above the floor and between the forward passenger partition or equipment bay and the forward pressure dome or equipment bay. Does not include cargo compartment. Includes direct and indirect illumination of work areas, panels, and instruments. Does not include bulbs and wiring inside of instruments which are removed with the instrument. Includes the master warning light system and the warning light dimming systems.

PASSENGER COMPARTMENTS/FLIGHT CREW COMPARTMENTS: The lighting subsystems not included in the flight compartment that are the areas in which the passengers are seated or flight crew stations and in buffet/galley, lavatories, lounges, and coat rooms. Includes items such as direct and indirect illumination, passenger call system, lighted signs, etc.

CARGO AND SERVICE COMPARTMENTS: The light subsystems in the compartments for stowage of cargo and the housing of various components and accessories.

EXTERIOR: The light subsystems used to provide illumination outside of the aircraft. Includes lights such as landing, navigation, position indicating, wing illumination, rotating, courtesy, taxi, etc.

EMERGENCY LIGHTING: The separate and independent subsystems used to provide illumination in case of primary electrical power failure. Includes items such as inertial flashlights, lanterns, etc.

12. FUEL SYSTEM MAINTENANCE PLAN: Those units and components which store and deliver fuel to the engine. Includes engine-driven fuel pumps for reciprocating engines, tanks (bladder), valves, boost pumps, etc., and those components which furnish a means of dumping fuel overboard. Includes integral and tip fuel tank leak detection and sealing.

SUBSYSTEMS

STORAGE: That portion of the system which stores fuel. Includes tank sealing, bladder-type cells, ventilating system, cell and tank interconnectors, over-wing filler necks and caps, etc. Also includes reservoir feed pumping systems and reservoirs within the tanks.

DISTRIBUTION: That portion of the system which is used to distribute fuel from the filler connector to the storage system and from the storage system to and including the power plant fuel quick disconnect. Includes items such as plumbing, pumps, valves, controls, etc.

DUMP: That portion of the system which is used to dump fuel overboard during flight. Includes such items as plumbing, valves, chutes, controls, etc.

INDICATING: That portion of the system which is used to indicate the quantity, temperature, and pressure of the fuel. Includes pressure warning systems for pumping systems within the tank, etc. Does not include engine fuel flow or pressure.

13. EMERGENCY/SURVIVAL EQUIPMENTS MAINTENANCE PLAN:

SUBSYSTEMS

SURVIVAL EQUIPMENT: Includes parachutes, survival kits (life rafts, first aid kits, etc.), pyrotechnics (flare guns and flares), etc.

EVACUATION/ESCAPE EQUIPMENT: Includes fire extinguishers, fire axes, emergency lights, emergency exit ladders, etc.

PERSONNEL EQUIPMENTS: Includes aviators clothing (coveralls, anti-exposure suits, anti"G" suits, torso harnesses, etc.), helmets, oxygen masks, bailout bottles and regulators, communications equipments, etc.

RADIATION/THERMAL SHIELDS: Includes shields, actuating and retract mechanisms, tracks, rails, seals, controls etc.

14. <u>ESCAPE SYSTEM MAINTENANCE PLAN</u>: Includes seats, rails, canopy breakers, sequencing devices, controls, retract/restraint devices, protective enclosures, ground safety devices, ejection cartridges, rockets, cartridge actuating devices, etc.

15. <u>LANDING GEAR SYSTEM MAINTENANCE PLAN</u>: Those units and components which furnish a means of supporting and steering the aircraft on the ground or water and make it possible to retract and store the landing gear in flight. Includes tail skid assembly, brakes, wheels, floats, skids, skis, doors, shock struts, tires, linkages, position indicating and warning systems.

<u>SUBSYSTEMS</u>

MAIN GEARS AND DOORS: That portion of the system which provides the major support for the aircraft while on the ground. Includes items such as shock struts, bogie axles, drag struts, doors, linkages, attach bolts, etc.

NOSE GEAR AND DOORS: That portion of the system which supports the nose of the aircraft while the aircraft is on the ground. Includes items such as shock struts, drag struts, doors, linkages, attach bolts, etc.

EXTENSION AND RETRACTION: That portion of the system which is used to extend and retract the landing gear and open and close the landing gear doors. Includes items such as actuating mechanisms, bogie trim, bungees, up and down latches, operating controls, valves and motors, cables, wiring, plumbing, etc.

WHEELS AND BRAKES: That portion of the system which provides for rolling and stopping the aircraft while on the ground and stopping wheel rotation after retraction. Includes items such as bearings, tires, valves, deboosters, swivel glands, anti-skid devices, pressure indicators, plumbing, etc.

STEERING: That portion of the system which is used to control the direction of movement of the aircraft on the ground. Includes items such as actuating cylinders, controls, bogie swivel unlock, etc.

POSITION AND WARNING: That portion of the system which is used to indicate and warn of the position of the landing gear/doors. Includes items such as switches, relays, lights, indicators, horns, wiring, etc.

SUPPLEMENTARY GEAR: Devices used to stabilize the aircraft while on the ground and prevent damage by ground contact. Includes items such as shock strut, skid block, wheels.

16. <u>CATAPULT AND ARRESTING GEAR SYSTEM MAINTENANCE PLAN</u>: Those mechanical, hydraulic, and electrical components used for control and operation of the arresting gear and catapult gear. Includes the arresting hook point and shank, catapult hook and holdback, and the associated pulleys, cables, cylinders, accumulators, valves, etc.

17. <u>FLIGHT CONTROL SYSTEM MAINTENANCE PLAN</u>: Those units and components which furnish a means of manually controlling the flight attitude characteristics of the aircraft including items such as hydraulic or electrical boost systems, rudder pedals, control column linkage, control cables, tab controls, mounting brackets, etc. Also includes the functioning and maintenance aspects of the flaps, spoilers, and other control surfaces.

<u>SUBSYSTEMS</u>

AILERON AND TAB: That portion of the system which controls the position and movement of the ailerons and aileron tabs. Includes items such as the control wheels, cables, boosters, linkages, control surfaces, position indicators, etc.

RUDDER AND TAB: That portion of the system which controls the position and movement of the rudder and rudder tabs. Includes items such as the rudder pedals, tab control wheel, cables, boosters, linkages, control surfaces, position indicators, etc.

ELEVATOR AND TAB: That portion of the system which controls the position and movement of the elevator/elevon and tabs. Includes items such as the control column, stick-shaker units, automatic stall recovery devices, tab control wheels, cables, boosters, linkages, control surfaces, position indicators, stall warning systems, etc.

HORIZONTAL STABILIZERS: That portion of the system which controls the position and movement of the horizontal stabilizer/canard. Includes items such as control column, cables, jackscrews, motors, warning systems, linkages, control surfaces, position indicators, etc.

FLAPS: That portion of the system which controls the position and movement of the trailing edge flaps. Includes items such as control handles, cables, actuators, warning systems, linkages, control surfaces, position indicators, etc.

SPOILER, DRAG DEVICES AND VARIABLE AERODYNAMIC FAIRINGS: That portion of the system which controls the position and movement of the spoilers, drag devices, and variable aerodynamic fairings. Includes items such as control handles, cables, warning systems, linkages, spoilers, drag devices, position indicators, etc.

GUST LOCK AND DAMPENER: That portion of the system which protects the control surfaces from movement by wind while the aircraft is on the ground. Does not include locking the control by means of flight control boost system.

LIFT AUGMENTING: That portion of the system which controls the position and movement of variable opening wing slots, leading edge wing flaps, and other similar auxiliary devices used for increasing aerodynamic lift. Includes items such as control handles, cables, actuators, linkages, warning systems, control surfaces, position indicators, etc. Does not include trailing edge flaps.

18. <u>FUSELAGE MAINTENANCE PLAN</u>: The structural units and associated components/members which make up the components for equipment, passengers, crew, and cargo, including skin, belt frames, stringers, floor beams, floor, pressure dome, scuppers, tail cone, fuselage to wing and empennage fillets, etc.

<u>SUBSYSTEMS</u>:

MAIN FRAME: The primary skeleton of the fuselage, includes frames, bulkheads, formers, longerons, stringers, keel, frames around openings, etc.

AUXILIARY STRUCTURE: The secondary structure of the fuselage. Includes floor, interval stairs, and fixed partitions.

PLATES/SKIN: The exterior covering of the fuselage including access covers, doublers, and armor plating.

ATTACH FITTINGS: The fittings on the fuselage used for the attachment of doors, wings, stabilizers, landing gear, engine and rotor pylons, external stores and weapons, and for the support of equipment within the fuselage. Includes items such as seat tracks, cargo basket rails, instrument brackets, etc.

AERODYNAMIC FAIRINGS: The structure of fixed aerodynamic fairings such as those on the nose and tail and between the fuselage and the wing and the stabilizers. Includes items such as wing/fuselage fillets, nose and tail cones, radome, etc. Does not include the functioning and maintenance aspects of variable aerodynamic fairings.

19. <u>WING MAINTENANCE PLAN:</u> Those center wing and outer wing structural units and associated components/members, integral fuel tank structures, and components that make up these units such as spars, skin, ribs, stringers, clamshells, scuppers, etc. Includes the structure of the flaps, ailerons, and spoilers. Also includes folding mechanism and external store mounts.

<u>SUBSYSTEMS</u>

MAIN FRAME: The primary skeleton of the wing. Includes spars, ribs, stringers, integral fuel tank structure, tip tank supporting structure, and frames around openings.

AUXILIARY STRUCTURE: The secondary structure of the wing. Includes leading edge, trailing edge, wing tip, tip fuel tank, and fuel or water cell backing boards. Does not include plates/skin.

PLATES/SKIN: The exterior covering of the wing including access covers, doublers, tip tank fillets/fairings, and armor plating.

ATTACH FITTINGS: The fittings on the wing used for the attachment of fuselage, nacelle/pylon, landing gear, and external stores/weapons to the wing, and for support of equipment within the wing.

FLIGHT SURFACES: The structure of removable airfoils attached to the wing. Includes items such as ailerons, flaps, spoilers, tabs, drag and balancing devices, etc.

20. <u>STABILIZER MAINTENANCE PLAN:</u> The horizontal and vertical stabilizers include the structure of the elevator and rudder.

<u>SUBSYSTEMS</u>

HORIZONTAL STABILIZERS: The horizontal airfoil of the tail/nose section to which the elevator/canard is attached. Includes items such as spars, ribs, stringers, plates/ski access covers, tips, etc.

ELEVATOR/ELEVON: The removal airfoil which is used for longitudinal and lateral control. Includes items such as spars, ribs, stringers, plates/skin, access covers, tabs, balance devices, etc.

VERTICAL STABILIZERS: The vertical airfoil to which the rudder is attached. Includes items such as spars, ribs, stringers, plates/skin, access covers, tips, etc.

RUDDER: The removable airfoil which is attached to the vertical stabilizer and is used for yaw control. Includes items such as spars, ribs, stringers, plates/skin, access covers, tabs, balance devices, etc.

ATTACH FITTINGS: The fittings on the stabilizers used for the attachment of stabilizers, elevators, rudder tabs, fillets/fairings, and for the support of equipment within the stabilizer.

21. <u>NACELLES/PYLONS MAINTENANCE PLAN:</u> Those structural units and associated components/members which furnish a means of housing and mounting the power plant or rotor assembly. Includes skin, longerons, belt frames, stringers, clamshells, scuppers, doors, nacelle fillets, etc. Also includes the structure of the power plant cowling.

SUBSYSTEMS

MAIN FRAME: The primary skeleton of the nacelle or pylon. Includes items such as frames, bulkheads, firewalls, stringers, keel, frames around openings, etc.

AUXILIARY STRUCTURE: The secondary structure in the nacelles/pylons. Includes leading and trailing edge structure, etc. Does not include plates, skin.

PLATES/SKIN: The exterior covering of the nacelle or pylon including access covers, cowling, doublers, and armor plating.

ATTACH FITTINGS: The fittings on the nacelles/pylons used for the attachment to its connecting structure, power plant, thrust reverser, and for the support of equipment within the nacelle/pylon.

FILLETS/FAIRINGS: The aerodynamic fairings between the nacelle or pylon and its connecting structure.

22. DOOR MAINTENANCE PLAN: Those removable units used for entrance or exit and for enclosing other structures contained within the fuselage. Includes passenger and crew doors, cargo doors, emergency exits, etc. Electrical and hydraulic systems associated with door control are included as appropriate.

SUBSYSTEMS

PASSENGER/CREW: The doors used for entrance and exit of the passengers and crew to and from the aircraft. Includes such items as structure, latching mechanisms, handles, insulation, lining, controls, integral steps, ramps, and handrails.

EMERGENCY EXIT: The exit doors used to facilitate evacuation that are not normally used for exit. Includes items such as structure, latching mechanisms, handles, insulation, lining, controls.

CARGO: The exterior doors used primarily to gain access to cargo compartments. Includes items such as structure, latching mechanisms, handles, insulation, lining, controls, integral steps, ramps, handrails, etc.

SERVICE: The exterior doors used primarily to gain access for servicing/maintenance of aircraft systems and equipment. Includes items such as structures, latching mechanisms, handles, insulation, lining, controls, integral steps, handrails, etc.

FIXED INTERIOR: The doors inside the fuselage installed in fixed partitions. Includes items such as structure, latching mechanisms, handles, lining, etc. Does not include doors installed in movable partitions.

ENTRANCE STAIRS: The stairs which operate in conjunction with but are not an integral part of entrance doors. Stairs whose primary structure is a door shall be covered under the appropriate topic. Includes items such as structure, actuating mechanisms and controls, handrails, etc.

DOOR WARNING: The portion of the system which is used to indicate whether the doors are closed and properly latched. Includes items such as switches, lights, bells, horns, etc.

CANOPY: Includes the transparent material and frame, canopy actuators, and emergency jettison devices as well as rails, latches, seals, etc.

PANELS: Includes those removable units used primarily to gain access to interior compartments for maintenance and inspection of systems and equipments. Includes items such as structure, insulation, lining, fasteners, seals, drains, etc.

23. <u>WINDOW MAINTENANCE PLAN</u>: Those fuselage and crew compartment windows inclusive of windshields; also those windows installed in doors.

<u>SUBSYSTEMS</u>

FLIGHT COMPARTMENT/COCKPIT: Those transparent areas, exclusive of canopies, used by the flight crew in flight or in ground handling for visual exterior observation that is contained in the compartment above the floor and between the forward pressure dome or equipment bay and the forward passenger compartment or equipment bay. Includes such items as the transparent material and its frame or sliding and fixed windows and windshields, handles, latching mechanisms, etc. Does not include door or inspection/observation windows.

CABIN: Those transparent areas in which the passengers are seated or the flight crew (other than cockpit personnel) are stationed. Includes lounges, lavatories, buffets/galleys, coat rooms, and emergency exit windows. Includes items such as transparent material, its frame, frost shield, etc.

DOOR: The transparent areas within doors used for entrance and exit of the passengers, flight crew, and service personnel to and from the airplane. Includes items such as transparent material, its frame, etc. Does not include emergency exit windows.

INSPECTION AND OBSERVATION: The transparent areas used for examining compartments and equipment in and about the airplane, and the astrodomes used for celestial navigation. Includes items such as transparent material, its frame, etc.

24. __PROPELLER SYSTEM MAINTENANCE PLAN__: The complete mechanical or electrical propeller, pumps, motors, governor, alternators, and those units and components external to or integral with the engine used to control the propeller blade angle. Includes propeller spinner, synchronizers, etc.

__SUBSYSTEMS__

PROPELLER ASSEMBLY: That portion of the system which rotates except the engine propeller shaft. Includes items such as blades, dome, hub, spinner, slip rings, de-icer boot, distributor valve, etc.

Controlling: That portion of the system which controls the pitch of the propeller blades. Includes such items as governor, synchronizer, braking mechanisms, indicating pulleys, plumbing, etc.

REDUCTION GEAR AND SHAFT SECTION: The removable section of engine which contains the propeller shafts and reduction gears. Includes items such as drives for nose mounted accessories, reduction gearing, gear trains, extension shaft, torque meter system, etc.

25. __ROTOR SYSTEM MAINTENANCE PLAN__: The complete rotor system including transmission, rotor heads, rotor blades, and accessory drives. Also includes rotor braking and blade angle and altitude control system.

SUBSYSTEMS:

MAIN ROTOR: That portion of the system which rotates about a substantially vertical axis to provide lift and thrust or lift only. Includes items such as blades, heads, gear boxes, rain shields, transmissions, fairings, etc. Also includes the rotating portion of the ice and rain protection system.

Controlling: That portion of the system which controls the pitch and angle of attack of the rotor blades. Includes items such as governor, synchronizers, switches, wiring, cables, levers, etc. Does not include any parts which rotate with the rotor assembly.

Braking: That portion of the system which is used to decrease rundown time to stop rotor rotation during engine power off conditions. Includes brake mechanisms, levers, pulleys, cables, switches, wiring, plumbing, etc.

ANTI-TORQUES ROTOR ASSEMBLY: That portion of the system which rotates in a plane substantially parallel to the plane of symmetry to furnish a thrust which counteracts the torque of the main rotor and provides direction control. Includes items such as blades, hubs, shafts, couplings, gear boxes, transmissions, etc.

26. ENGINE TURBINE/TURBOPROP/TURBOFAN MAINTENANCE PLAN

SUBSYSTEMS

AIR INLET SECTION: The section of the engine through which the air enters the compressor section. Includes items, such as guide vanes, shrouds, cases, etc.

COMPRESSOR SECTION: The section of the engine in which the air is compressed. Includes items such as cases, vanes, shrouds, rotors, diffusers, etc.

COMBUSTION SECTION: The section of the engine in which the air and fuel are combined and burned. Includes items such as burner cans, cases, etc.

TURBINE SECTION: The section of the engine containing the turbines. Includes such items as turbine nozzles, turbine rotors, cases, etc.

BYPASS SECTION: The section of the engine which bypasses a portion of the normal engine airflow (either ram or compressed air) for the prime purpose of adding to engine thrust or reducing specific fuel consumption.

AUGMENTATION SECTION: The section of the engine utilized for the recovery of and/or addition of power to the engine system.

ENGINE FUEL AND CONTROL: For turbine engines, those units and components and associated mechanical systems or electrical circuits which furnish or control fuel to the engine and thrust augmentor beyond the main fuel quick disconnect, fuel flow rate sensing, transmitting, and/or indicating units, whether the units are before or beyond the quick disconnect. Includes coordinator or equivalent, engine-driven fuel pump and filter assembly, main and thrust augmentor fuel controls, electronic temperature datum control, temperature datum valve, fuel manifold, fuel nozzles, fuel enrichment system, speed sensitive switch, relay box assembly, solenoid drip valve, burner drain valve, etc.

Distribution: That portion of the system from the main quick disconnect to the engine which distributes fuel to the engine burner section and the thrust augmentor. Includes items such as plumbing, pumps, temperature regulators, valves, filters, manifold, nozzles, etc. Does not include the main or thrust augmentor fuel control.

Controlling: The main fuel controls which meter fuel to the engine and to the thrust augmentor. Includes items such as levers, cables, pulleys, linkages, etc., which are components of the fuel control units.

Indicating: That portion of the system which is used to indicate the flow rate, temperature and pressure of the fuel. Includes items such as transmitters, indicators, wiring, etc.

ENGINE CONTROLS: Those controls which govern operation of the engine. Includes units and components which are interconnected for emergency shutdown. For turboprop engines, includes linkages and controls to the coordinator or equivalent to and from the coordinator or equivalent to the propeller governor, fuel control unit, or other units being controlled. For reciprocating engines, include controls for blowers.

Power Control: That portion of the system which furnishes a means of controlling the main fuel control or coordinator. Includes controls to the propeller regulator on turboprop engines. Includes items such as linkages, cables, levers, pulleys, switches, wiring, etc. Does not include the units themselves.

Emergency Shutdown: That portion of the system which furnishes a means of controlling the flow of fluids to and from the engine during emergency procedures. Includes items such as levers, cables, pulleys, linkages, switches, wiring, etc. Does not include the units themselves.

ENGINE INDICATING: Those units, components, and associated systems which indicate engine operation. Includes indicators, transmitters, analyzers, etc. For turboprop engines, includes phase detectors.

Power: That portion of the system which directly or indirectly indicates power or thrust. Includes items such as BMEP, pressure-ratio, RPM, etc.

Temperature: That portion of the system which indicates temperatures in the engine. Includes items such as cylinder head, exhaust (turbine inlet), etc.

Analyzers: That portion of the system which is used to analyze engine system performance or condition by means of instruments or devices such as oscilloscopes, etc. Includes items such as generators, wiring, amplifiers, oscilloscopes, monitoring systems, recording systems, etc.

IGNITION SYSTEM: Those units and components which generate, control, furnish, or distribute an electrical current to ignite the fuel-air mixture in the cylinders of reciprocating engines or in the combustion chambers of thrust augmentors of turbine engines. Includes induction vibrators, magnetos, switches, lead filters, distributors, harnesses, plugs, ignition relays, exciters, and the electrical portion of spark advance.

Electrical Power Supply: That portion of the system which generates electrical current for the purpose of igniting the fuel mixture in the combustion chambers and thrust augmentors. Includes items such as magnetos, distributors, booster coils, exciters, transformers, storage capacitors, compositors, etc.

Distribution: That portion of the system which conducts high or low voltage electricity from the electrical power supply to the spark plug or igniters. Includes wiring between magneto and distributor in those systems where they are separate units. Includes such items as ignition harness, high tension leads, coils as used in "low tension" systems, spark plugs, ingiters, etc.

Switching: That portion of the system which provices a means of rendering the electrical power supply inoperative. Includes items such as ignition switches, wiring, connectors, etc.

OIL SYSTEM: Those units and components external to the engine concerned with storing and delivering lubricating oil to and from the engine, as well as those used to distribute oil throughout the engine. Includes tanks, radiators, pumps, strainers, valves, etc.

Storage: That portion of the system used for storage of oil. Includes such items as tanks, filling system, internal hoppers, baffles, tank sump and rain, etc.

Distribution: That portion of the system used to conduct oil from and to the engine and to distribute oil throughout the engine. Includes items such as plumbing, valves, temperature regulators, control systems, front and rear pressure and scavenger pumps, sumps, strainers, etc.

Indicating: That portion of the system which is used to indicate the quantity, temperature, and pressure of the oil. Includes items such as transmitters, indicators, wiring, warning systems, etc.

27. <u>POWER PLANT INSTALLATION MAINTENANCE PLAN</u>: The overall power package inclusive of engine, air intake, mount, cowling, scoops, cowl flaps.

<u>SUBSYSTEMS</u>

COWLING: Those removable coverings which extend over and around the power plant assembly. Includes the functioning and maintenance aspects of items such as the accessory section cowls, cowl flaps, cowling supports, attach and locking mechanisms, etc. Does not include the structure integral with the airframe.

MOUNTS: The framework, either of build-up construction or forgings which support the engine and attach it to the nacelle or pylon. Includes items such as engine mounts, vibration dampeners, support links, mounting bolts, etc.

FIRESEALS: Those fire-resistant partitions and seals mounted on or about the power package for the purpose of isolating areas subject to fire.

ATTACH FITTINGS: Those fittings and brackets which are used for the support of equipment in and about the power package.

ELECTRICAL HARNESS: Those electrical cables, conduits, plugs, sockets, etc., which serve several power plant systems but which are banded together to facilitate the removal and installation of the power plant.

AIR INTAKES: That portion of the power plant system which directs and may or may not vary the mass airflow to the engine. Includes items such as nose ring cowls, scoops, compressor fan cowls, buried engine ducts, vortex generators, actuators, control handles, cables, wiring, plumbing, linkages, doors, warning systems, position indicators, etc. Does not include integral structure with the airframe, which shall be included in the applicable STRUCTURE chapter.

ENGINE DRAINS: Those components and manifold assemblies which are used to drain off excess fluids from the power plant and its accessories. Includes drainlines, manifolds, tanks, flame arrestors, vents, and their supporting brackets, etc. Also includes components that are an integral part of, or are fitted to, the power plant cowling.

28. STARTING SYSTEM MAINTENANCE PLAN: Those units, components, and associated systems used for starting the engine. Includes electrical, inertial air or other starter systems, and items such as plumbing, valves, wiring, starters, switches, relays, etc.

29. ACCESSORY DRIVE SYSTEM MAINTENANCE PLAN: Those units and components, either engine-mounted or remotely installed and connected to the engine by a drive shaft, which drive multiple types of accessories. When engine mounted and supplied include in engine maintenance plan.

SUBSYSTEMS

DRIVE SHAFT SECTION: That portion of the system which is used to conduct power from the engine to the gearbox. Includes such items as drive shaft, adapters, seals, etc.

GEARBOX SECTION: The case which contains the gear trains and shafts. Includes items such as gears, shafts, seals, oil pumps, coolers, etc.

30. EXHAUST SYSTEM MAINTENANCE PLAN: Those units and components which direct the engine exhaust gases overboard. For turbine engines, include units external to the basic engine such as thrust reverser and noise suppressor. For reciprocating engines, includes augmentors, stacks, clamps, etc. Excludes exhaust driven turbines.

SUBSYSTEMS

COLLECTOR/NOZZLE: That portion of the system which collects the exhaust gases from the cylinders or turbines and conducts them overboard. Includes items such as collector rings, exhaust and thrust augmentor ducts, variable nozzles, actuators, plumbing linkages, wiring, position indicators, warning systems, etc. Does not include power recovery turbines, turbosuperchargers, etc., nor noise suppressors or thrust reversers where they are not an integral part of the nozzle system.

NOISE SUPPRESSORS: That portion of the system which reduces the noise generated by the exhaust gases. Includes items such as pipes, baffles, shields, actuators, plumbing, linkages, wiring, position indicators, warning systems, etc.

THRUST REVERSER: That portion of the system which is used to change the direction of the exhaust gases for reverse thrust. Includes items such as clamshells, linkages, levers, actuators, plumbing, wiring, indicators, warning systems, etc.

SUPPLEMENTARY AIR: That portion of the system which varies and controls supplementary airflow to the exhaust system. Includes items such as tertiary air doors, actuators, linkages, springs, plumbing, wiring, position indicators, warning systems, etc.

31. AIR SYSTEM MAINTENANCE PLAN: For turbine engines, those external units and components and integral basic engine parts which go together to conduct air to various portions of the engine and to the extension shaft and torquemeter assembly, if any. Includes compressor bleed systems used to control flow of air through the engine, cooling air systems, and heated air systems for engine anti-icing. Does not include aircraft anti-icing, engine starting systems, nor exhaust supplementary air systems.

SUBSYSTEMS

ENGINE ANTI-ICING. That portion of the system which is used to eliminate and prevent the formulation of ice by bleed air in all parts of the engine. Includes items such as valves, plumbing, wiring, regulators, etc.

ACCESSORY COOLING: That portion of the system which is used to control the flow of air through the engine. Includes items such as governors, valves, actuators, linkages, etc.

INDICATING: That portion of the system which is used to indicate temperature, pressure, control positions, etc., of the air systems. Includes items such as transmitters, indicators, wiring, etc.

32. HF COMMUNCIATON SYSTEM MAINTENANCE PLAN

33. VHF COMMUNICATION SYSTEM MAINTENANCE PLAN

34. UHF COMMUNICATION SYSTEM MAINTENANCE PLAN

35. INTERPHONE SYSTEM MAINTENANCE PLAN

36. IFF MAINTENANCE PLAN

37. EMERGENCY RADIO MAINTENANCE PLAN

38. COM-NAV-IFF INTEGRATED PACKAGE MAINTENANCE PLAN

39. MISCELLANEOUS COMMUNICATIONS MAINTENANCE PLAN: Includes digital data communication systems, sound recorders, antennas, and communication equipment not specified in other systems.

40. RADIO NAVIGATION MAINTENANCE PLAN: Airborne radio navigation aids (OMNI-range receiver, marker beacon, radio compass, TACAN, etc.).

41. RADAR NAVIGATION MAINTENANCE PLAN: Search, weather, and rendezvous radar (when not a part of bombing-navigation or fire control systems) and airborne radar navigational aids such as LORAN and radar altimeter.

42. BOMBING-NAVIGATION MAINTENANCE PLAN: Search and rendezvous, inertial navigation systems, bombing-navigation computers, controls, scopes, cameras, and sights.

43. WEAPONS CONTROL SYSTEM MAINTENANCE PLAN: Target acquisition and tracking radar, sights, scopes, computers, weapons direction equipment, gun cameras, associated racks, mounts and shackles.

44. WEAPONS DELIVERY SYSTEM MAINTENANCE PLAN: Installed launchers and related mechanisms, ammo feed and eject mechanisms, gun systems hoists, slings, sway braces, racks, releases, and AEC equipment.

45. ELECTRONIC COUNTERMEASURES MAINTENANCE PLAN: Chaff dispensers, aural and visual warning systems, passive defense systems, search receivers, jamming transmitters, track breaking equipment, electromagnetic reconnaissance equipment, and recorders.

46. PHOTOGRAPHIC/RECONNAISSANCE MAINTENANCE PLAN: Cameras, magazines, filters, controls, dehydrators, heaters, exposure counters, vibration isolators, intervalometers, bomb damage evaluators, and recorders, and small infrared reconnaissance radar sets.

47. INSTRUMENTS, GENERAL MAINTENANCE PLAN: Includes standard flight instruments, navigation instruments, and pitot static instruments. Does not include those indicators associated with electronic equipment.

48. AUTOPILOT MAINTENANCE PLAN: Includes pitch, yaw, and roll control systems when not a part of an integrated guidance and flight control system.

49. FLIGHT REFERENCE MAINTENANCE PLAN: Includes attitude computer groups, vertical and flight reference sets, compass sets, attitude heading reference sets, air data computers, and vertical gyro systems.

50. INTEGRATED GUIDANCE AND FLIGHT CONTROL MAINTENANCE PLAN: Include the autopilot when it is a part of the integrated system.

APPENDIX II

MPA WORKSHEETS

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MPA WORKSHEET 1 | **SIGNIFICANT ITEMS DETERMINATION**

(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

ALL POTENTIAL MAINTENANCE SIGNIFICANT ITEMS HARDWARE ORDER LISTING						(j) REDUNDANCY PROTECTION FAILSAFE FAIL INDICATION	(k) SIGNIF. ITEM	
(d) SEQ. NR.	(e) NOMENCLATURE	(f) PART NR.	(g) WUC/LSACN	(h) ZONE	(i) FUNCTIONAL DESCRIPTION		SCH	CORR

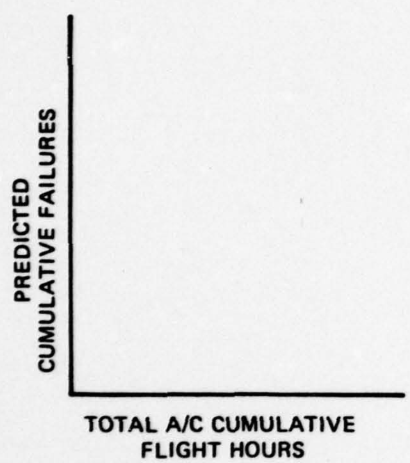
MPA WORKSHEET 2 | **FAILURE MODES AND EFFECTS ANALYSIS**

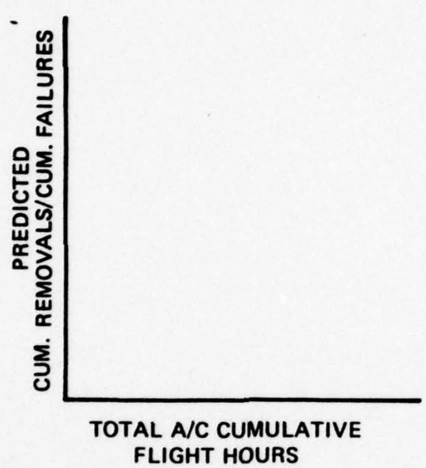
(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

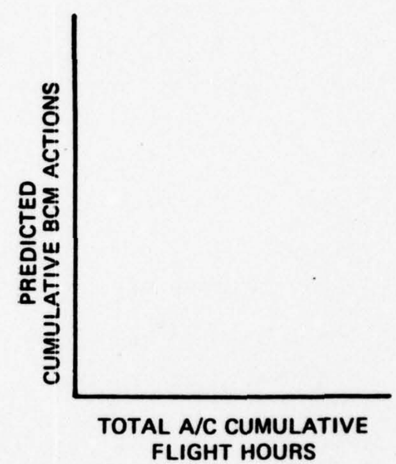
ALL POTENTIAL MAINTENANCE SIGNIFICANT ITEMS (MSI)

(d) SEQ. NR.	(e) FAILURE MODES		(f) FAILURE EFFECTS
	NR.	MODE	

MPA WORKSHEET 3	HARDWARE USAGE DEVELOPMENT	
(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: DATE: PREPARING ACTIVITY: REVISION: A/C APPLICATION: REV. DATE:
(d) WEAPONS REPLACEABLE ASSEMBLY POTENTIAL MAINTENANCE SIGNIFICANT ITEM (MSI) SEQUENCE NUMBER:		







MPA WORKSHEET 4 — POTENTIAL SCHEDULED MAINTENANCE REQUIREMENT DEVELOPMENT

(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATIONS:	DATE: REVISION: REV. DATE:

(d) ALL SEQ. NRS.	(e) GP. 7 QUES. YES ANS. NRS. AND SSI IDENT.	(f) GP. 5 QUES. YES ANSWER NRS.	(g) GP. 3 QUES. YES (Y) AND NO (N) ANS. 1	2	3	(h) FAIL MODE NR.	(i) POTENTIAL EFFECTIVE SCHEDULED MAINTENANCE REQUIREMENTS

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MPA WORKSHEET 5 **SCHEDULED MAINTENANCE REQUIREMENTS**

(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

(d) MSI W/SCHED. MAINT. RQMT. SEQ. NR.	(e) SCHEDULED MAINTENANCE REQUIREMENTS TO BE DONE	(f) FREQUENCY	(g) MAINT. LEVEL	(h) GROUND SUPPORT EQUIPMENT REQUIRED

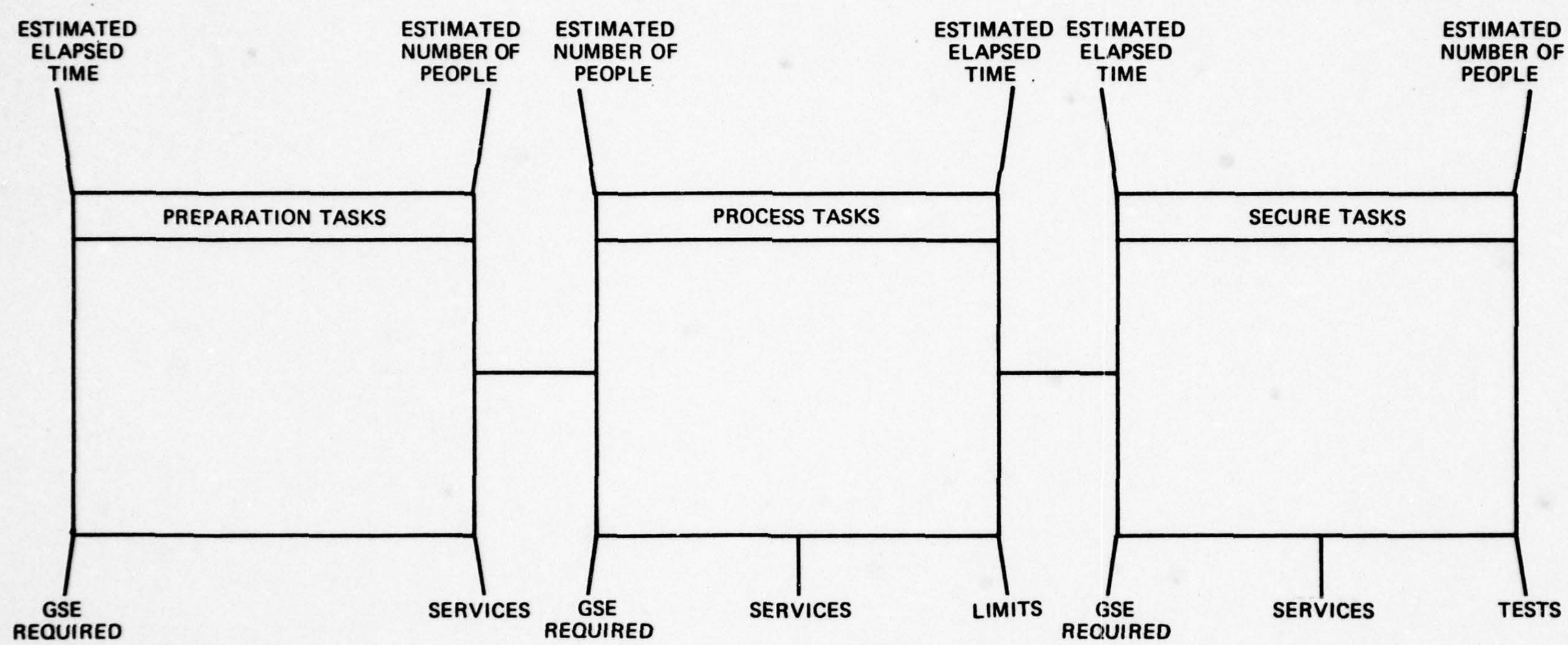
85/86

MPA WORKSHEET 6 — **SCHEDULED MAINTENANCE REQUIREMENTS TASK ANALYSIS**

(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

SCHEDULED MAINT. RQMT. TO BE DONE:

CORRESPONDING MSI SEQUENCE NR.:



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MPA WORKSHEET 7 | **FAILURE CAUSES AND RESTORATIVE ACTION**

(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

(d) ALL SEQ. NRS.	(e) FAIL MODE NR.	(f) CAUSES	(g) RESTORATIVE ACTION		(h) PREDICTED % OF WRA FAILURES
			NR.	ACTION	

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MPA WORKSHEET 8 **GSE/SM&R CODE DEVELOPMENT**

(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

(d)	(e)	(f) FAULT ISOLATION TO		(g) REMOVE/REPLACE AND/OR CHECK/TEST		(h) RESTORATION OF		
ALL SEQ. NRS.	FAIL MODE NR.	MAINT. LEVEL	GSE	MAINT. LEVEL	GSE	REST. ACT. NR.	MAINT. LEVEL	GSE

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MPA WORKSHEET 9 **ECONOMIC LEVEL OF REPAIR ANALYSIS RESULTS**

(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

(d) SEQ. NR.	(e) PREDICTED FAILURE RATE	(f) PREDICTED COST	(g) PREDICTED REMOVAL RATE	(h) TOTAL LIFE CYCLE LOGISTICS COST BASED ON PREDICTIONS			
				REPAIR I ($)	REPAIR D ($)	SPLIT I ($)	DISCARD ($)

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MPA WORKSHEET 10 **SSI (STRUCTURAL SIGNIFICANT ITEM) ANALYSIS**

(a) SUBJECT	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

(d) SSI SEQ. NR.:

(e) STRUCTURE CRITICALITY RATING (R)						(f)	(g) STRUCTURAL EXAMINATION	
(1) FATIGUE RESISTANCE RATING	(2) CORROSION RESISTANCE RATING	(3) CRACK PROPAGATION RESISTANCE RATING	(4) DEGREE OF REDUNDANCY RATING	(5) FATIGUE TEST RATING	(6) OVERALL RATING	EXTERNAL DETECTABILITY CATEGORY	INTERNAL SAMPLE AT DEPOT	EXTERNAL INSPECTION AT FLEET LEVEL

(h) STRUCTURAL EXAMINATION REQUIREMENT DESCRIPTION

(1) INTERNAL SAMPLING INSPECTION	(2) FREQ.	(3) EXTERNAL INSPECTION	(4) FREQ.

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APPENDIX III

MAINTENANCE PLAN FORMAT

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MAINTENANCE PLAN FORMAT

The Maintenance Plan is under three headings: General Considerations, Repair Capability and Maintenance Requirements.

Part I - GENERAL CONSIDERATIONS

a. Heading

(1) Nomenclature/Designation: Enter the generic name of the Maintenance Plan Subject Hardware and its type designator (if applicable).

(2) Prepared by: Enter the name of the maintenance engineer preparing the plan.

(3) Date: Enter the date the Maintenance Plan is completed.

(4) Application: Enter the aircraft model(s) on which the Maintenance Plan Subject Hardware is used.

(5) WUC/LSACN: Enter the Work Unit Code (WUC), if available, for the Maintenance Plan Subject Hardware. Enter the Logistic Support Analysis Control Number (LSACN) if no WUC is available.

(6) Part Number: Enter the manufacturer's part number and National Stock Number (NSN) (if available) of the Maintenance Plan Subject Hardware.

(7) Preparing Activity: Enter the activity (Naval or contractor) of the preparing maintenance engineer.

(8) Revision: Enter the revision letter (when applicable).

(9) Revision Date: Enter the date of the revision (when applicable).

b. Narrative - provide the following information in three separate narrative paragraphs.

MAINTENANCE PLAN

PART I - GENERAL CONSIDERATION

Nomenclature/Designation	Prepared by	Date	Application	WUC/LSACN
Part Number (NSN)	Preparing Activity		Revision	Revision Date

Narrative	
Approved By	Date

MAINTENANCE PLAN

Nomenclature/Designation | PART I - GENERAL CONSIDERATION *(continued)* | Revision

Narrative (continued)

Part II - REPAIR CAPABILITY

The format is to be completed as follows:

a. Heading - same as Part I

b. Repairable Items: These columns shall identify all repairable items within the Maintenance Plan Subject Hardware.

(1) WUC/LSACN for each repairable item - This column shall list the same number as Part I but the number system now is expanded (by adding digits) to identify items within the Maintenance Plan Subject Hardware.

(2) Part Number - This column shall list the manufacturer's part number and NSN (when available) for each repairable item.

(3) Nomenclature: This column shall identify each repairable item by brief description.

(4) Source, Maintenance and Recoverability (SM&R) Code: This column shall provide an SM&R Code for each repairable item in accordance with NAVAIRINST 4423.3A.

(5) Maintenance Replacement Factor: This column shall provide a maintenance replacement factor for each applicable repairable item. The maintenance factor for a repairable assembly will be beyond the repair capability of Intermediate and Organizational levels of maintenance in one maintenance cycle and will be reworked by a Depot.

$$\text{MRF} = \frac{\text{Maintenance Cycle (flight hours)}}{\text{Average Time Between Depot Rework in Hours (must be related to flight hours)}}$$

NOTE: Maintenance cycle for aircraft and airborne equipment is 100 aircraft flight-hours. For other equipments refer to the Program Support Inventory Control Point for maintenance cycle base interval.

(6) Depot Recovery Factor: The ratio, expressed as a percentage (decimal), between the total quantity of an item inducted into depot and the quantity of the same item returned to ready for issue (RFI) condition.

(7) System Recovery Factor: The overall system percentage of removals which are expected to generate into RFI condition.

(8) Rotable Pool Factor: This column shall provide the predicted number of times a repairable will be removed from an aircraft/engine/equipment and be restored by an intermediate level of maintenance to a ready for use condition during one maintenance cycle.

NOTE (1): Items (6) through (8) may not be required for Ground Support Equipment, Airborne Weapons, Targets and Armament. Other factors pertinent to the support of these equipments may be substituted.

NOTE (2): Items (5) through (8) are not required for in-service items being satisfactorily supported. In these instances enter the words "current usage data applies" starting with item (5).

c. Approved by and Date: Same as Part I

MAINTENANCE PLAN

PART II - REPAIR CAPABILITY

Nomenclature/Designation	Prepared by	Date	Application	WUC/LSACN
Part Number (NSN)	Preparing Activity		Revision	Revision Date

Repairable Items							
WUC/LSACN	PART NUMBER (NSN)	NOMENCLATURE	SM&R CODE	MRF	SYSTEM RECOVERY FACTOR	DEPOT RECOVERY FACTOR	ROTABLE POOL FACTOR

Approved By	Date

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MAINTENANCE PLAN

Nomenclature/Designation

PART II - REPAIR CAPABILITY *(continued)*

Revision

Repairable Items (continued)							
WUC/LSACN	PART NUMBER (NSN)	NOMENCLATURE	SM&R CODE	MRF	SYSTEM RECOVERY FACTOR	DEPOT RECOVERY FACTOR	ROTABLE POOL FACTOR

Part III - MAINTENANCE REQUIREMENTS

a. Heading - Same as Part I

b. Requirement Number: This column shall be used to number each maintenance requirement for the Maintenance Plan Subject Hardware.

c. Requirement: This column shall be used to list all the maintenance requirements for the Maintenance Plan Subject Hardware. The maintenance requirements shall fall within one of the following categories:

(1) Scheduled - Inspect (calendar/phase, daily, turnaround, special), service, functional check/test, adjust/calibrate/align/rig, repair, planned removal/replacement (Scheduled Removal Components).

(2) Corrective - Inspect (conditional), fault isolate/troubleshoot, remove/replace, repair, functional check/test, rework.

d. Maintenance Level: This column shall be used to identify the maintenance levels at which the requirement may be accomplished (Organizational, Intermediate, or Depot).

e. Interval: This column shall be used to list the interval associated with the scheduled maintenance requirements (flight hours, calendar period, cycles, starts, etc.). When applied to corrective requirements, use N/A (not applicable).

f. Ground Support Equipment Required: This column shall be used to identify the ground support equipment required for accomplishment of the maintenance requirement. Both peculiar and common GSE shall be listed, perferably by part number, or by word functional description.

g. Approved by and Date: Same as Part I

NOTE: Do not repeat the headings and approval/date blocks on continuation sheets of the Maintenance Plan. Only Part I, Part II and Part III first pages require these blocks. Use the Maintenance Plan title and the part title at the top of continuation sheets and a page number at the bottom. Each part should be numbered separately.

MAINTENANCE PLAN

PART III - MAINTENANCE REQUIREMENTS

Nomenclature/Designation	Prepared by	Date	Application	WUC/LSACN
Part Number (NSN)	Preparing Activity		Revision	Revision Date

REQ. NUM-BER	REQUIREMENT	MAINTENANCE LEVEL	INTERVAL	GROUND SUPPORT EQUIPMENT REQUIRED
APPROVED		DATE		

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MAINTENANCE PLAN

Nomenclature/Designation ______ PART III - MAINTENANCE REQUIREMENTS *(continued)* Revision ______

REQ. NUM-BER	REQUIREMENT	MAINTENANCE LEVEL	INTERVAL	GROUND SUPPORT EQUIPMENT REQUIRED

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APPENDIX IV

ANNOTATED MPA WORKSHEETS

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MPA WORKSHEET 1 | **SIGNIFICANT ITEMS DETERMINATION**

(a) SUBJECT	(b) WUC/LSACN	(c)	
MAINTENANCE PLAN CANDIDATE NOMENCLATURE AND PART NUMBER		PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

ALL POTENTIAL MAINTENANCE SIGNIFICANT ITEMS HARDWARE ORDER LISTING						(j) REDUNDANCY PROTECTION FAILSAFE FAIL INDICATION	(k) SIGNIF. ITEM	
(d) SEQ. NR.	(e) NOMENCLATURE	(f) PART NR.	(g) WUC/LSACN	(h) ZONE	(i) FUNCTIONAL DESCRIPTION		SCH	CORR
	Worksheet 1 inputs to the Maint. Plan				Design info <u>Part I</u> of Maintenance Plan	Design info <u>Part I</u> of Maint. Plan	Maint Rqmts Info Part III of Maint Plan	Re-pair-able Item List-ing Part II of Maint Plan
	<u>WORKSHEET 1 INPUTS TO OTHER LOGISTIC ELEMENTS</u> ILLUSTRATED PARTS BOOK WUC MANUAL MAINTENANCE PUBLICATIONS REPAIRABLE COMPONENTS LISTING ZONE INFO FOR MAINTENANCE REQUIREMENTS CARDS <u>WORKSHEET 1 INPUTS TO THE DEVELOPMENT PROGRAM</u> RELIABILITY IMPACT DETERMINATIONS SURVIVABILITY DETERMINATIONS MAINTAINABILITY ITEM IMPACTS							

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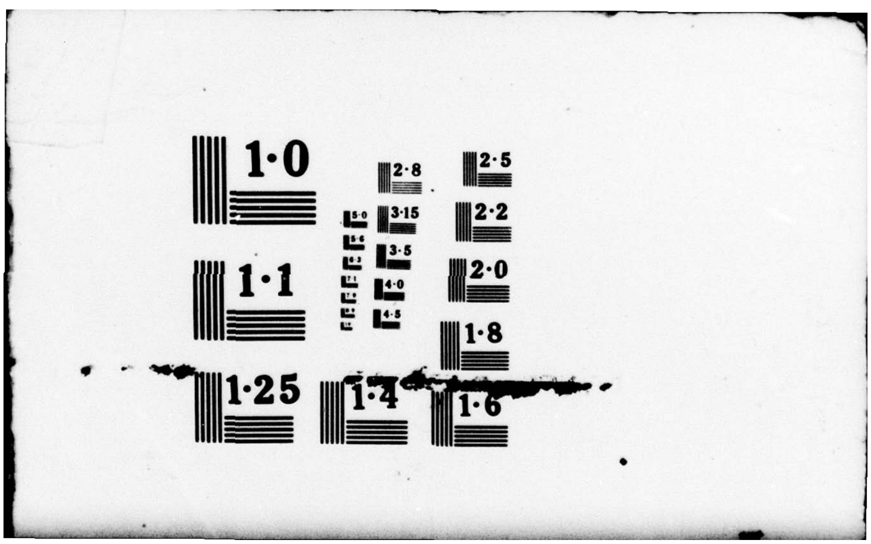
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5·0
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3·5
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4·0
2·0
4·5
1·8
1·25
1·4
1·6

MPA WORKSHEET 2 | **FAILURE MODES AND EFFECTS ANALYSIS**

(a) SUBJECT	(b) WUC/LSACN	(c)	
MAINTENANCE PLAN CANDIDATE NOMENCLATURE AND PART NUMBER		PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

ALL POTENTIAL MAINTENANCE SIGNIFICANT ITEMS (MSI)

(d) SEQ. NR.	(e) FAILURE MODES		(f) FAILURE EFFECTS
	NR.	MODE	

WORKSHEET 2 SUPPORTS THE MPA AND HAS NO DIRECT INPUTS TO THE LOGISTIC ELEMENTS

<u>WORKSHEET 2 INPUTS TO THE DEVELOPMENT PROGRAM</u>

SURVIVABILITY DETERMINATIONS
RELIABILITY IMPACT DETERMINATIONS
MAINTAINABILITY IMPACT DETERMINATIONS

MPA WORKSHEET 3

HARDWARE USAGE DEVELOPMENT

(a) SUBJECT	(b) WUC/LSACN	(c)	
MAINTENANCE PLAN CANDIDATE NOMENCLATURE AND PART NUMBER		PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

(d) WEAPONS REPLACEABLE ASSEMBLY POTENTIAL MAINTENANCE SIGNIFICANT ITEM (MSI) SEQUENCE NUMBER:

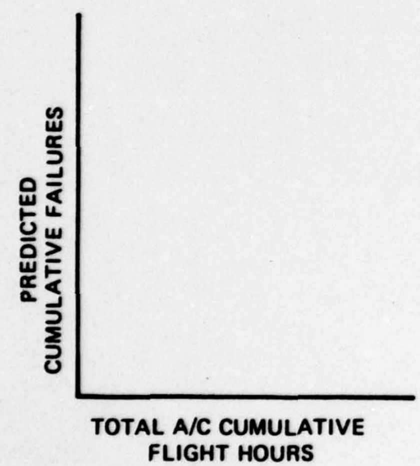
<u>WORKSHEET 3 INPUTS TO OTHER LOGISTIC ELEMENTS</u>

SOME INDICATION OF FALSE REMOVAL THROUGH REM/FAIL RATIO INDICATES NEED FOR GOOD FAULT ISOLATION PUB INFO/EFFECTIVE FAULT ISOLATION GSE AND EFFECTIVE FAULT ISOLATION TRAINING

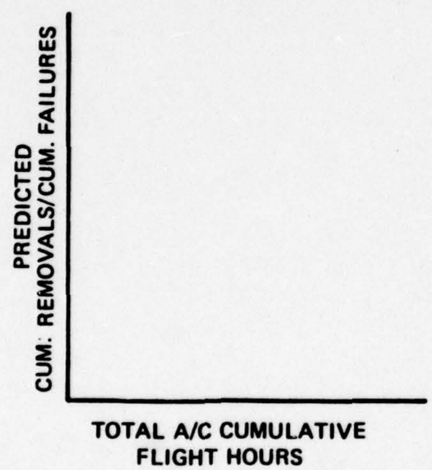
SUPPLY SUPPORT - INPUTS TO PIECE PART DETERMINATIONS AND LOCATION INPUTS TO SPARES DETERMINATION

<u>WORKSHEET 3 INPUTS TO THE DEVELOPMENT PROGRAM</u>

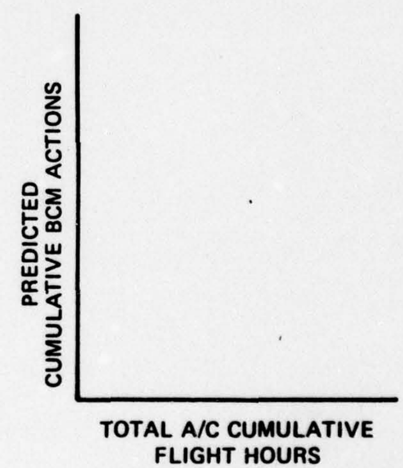
RELIABILITY IMPACT DETERMINATIONS. MAINTAINABILITY IMPACT DETERMINATIONS.



WORKSHEET 3 INPUTS TO THE MAINT. PLAN



MRF AND RPF INPUTS PART II OF MAINTENANCE PLAN



RECOVERY FACTOR INPUTS PART II OF MAINT. PLAN

MPA WORKSHEET 4	POTENTIAL SCHEDULED MAINTENANCE REQUIREMENT DEVELOPMENT				
(a) SUBJECT MAINTENANCE PLAN CANDIDATE NOMENCLATURE AND PART NUMBER			(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATIONS:	DATE: REVISION: REV. DATE:
(d) ALL SEQ. NRS.	(e) GP. 7 QUES. YES ANS. NRS. AND SSI IDENT.	(f) GP. 5 QUES. YES ANSWER NRS.	(g) GP. 3 QUES. YES (Y) AND NO (N) ANS. 1 2 3	(h) FAIL MODE NR.	(i) POTENTIAL EFFECTIVE SCHEDULED MAINTENANCE REQUIREMENTS
					WORKSHEET 4 SUPPORTS THE MPA AND HAS NO DIRECT INPUT TO OTHER LOGISTIC ELEMENTS OR THE DEVELOPMENT PROGRAM

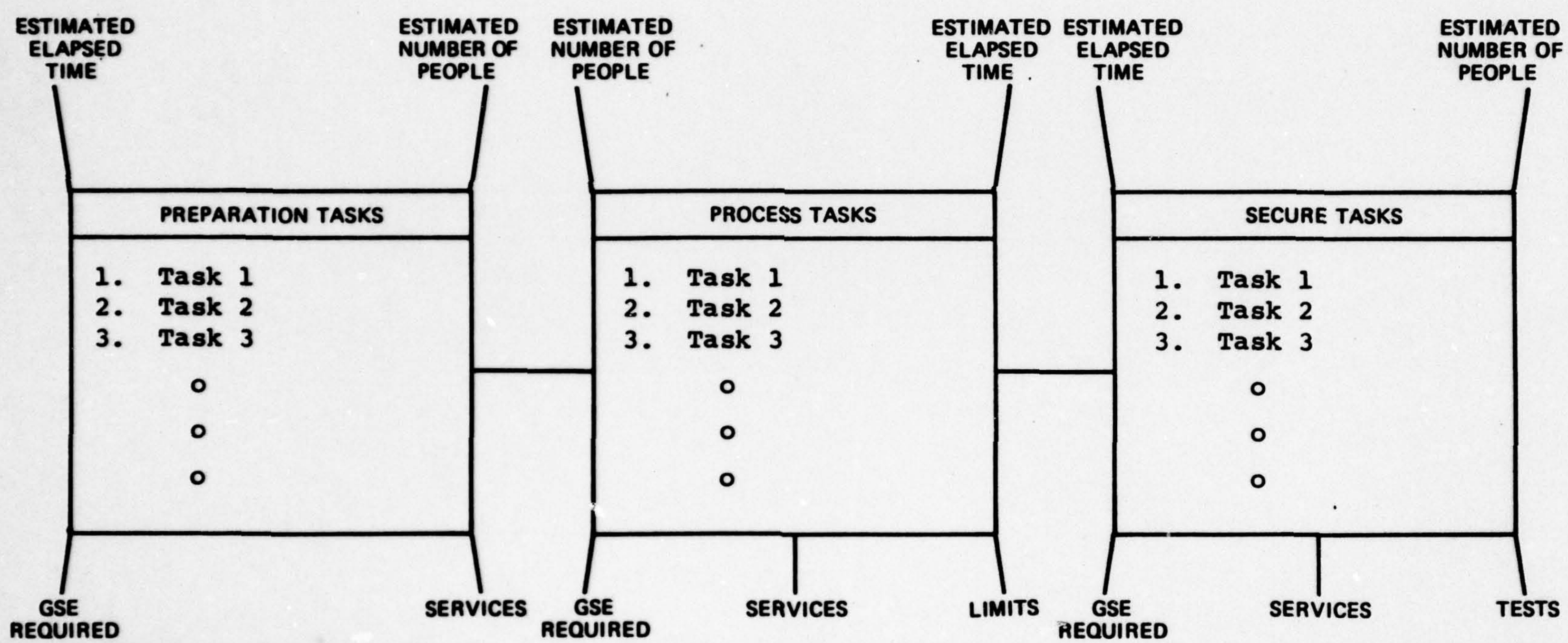
MPA WORKSHEET 5	SCHEDULED MAINTENANCE REQUIREMENTS			
(a) SUBJECT MAINTENANCE PLAN CANDIDATE NOMENCLATURE AND PART NUMBER	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:		DATE: REVISION: REV. DATE:

(d) MSI W/SCHED. MAINT. RQMT. SEQ. NR.	(e) SCHEDULED MAINTENANCE REQUIREMENTS TO BE DONE	(f) FREQUENCY	(g) MAINT. LEVEL	(h) GROUND SUPPORT EQUIPMENT REQUIRED
WORK-SHEET INPUTS TO THE MAINT. PLAN	SCHEDULED MAINTENANCE REQUIREMENTS PART III OF MAINTENANCE PLAN	SCHED MAINT. REQMT INTER-VAL PART III OF MAINT. PLAN	SCHED MAINT. REQMT MAINT. LEVEL PARTIII OF MAINT. PLAN	GSE FOR SCHED. MAINT. REQMTS. PART III OF MAINT. PLAN

WORKSHEET 5 INPUTS TO OTHER LOGISTIC ELEMENTS

DIRECT INPUT TO MAINTENANCE REQUIREMENT CARDS AND SDLM REQUIREMENTS
GSE DETERMINATION INPUTS
TRAINING REQUIREMENT INPUTS
SKILL LEVEL INPUTS
SUPPLY SUPPORT - SCHEDULED MAINT. PIECE PART DETERMINATION INPUT - QUANTITY AND LOCATION

MPA WORKSHEET 6	SCHEDULED MAINTENANCE REQUIREMENTS TASK ANALYSIS	
(a) SUBJECT MAINTENANCE PLAN CANDIDATE NOMENCLATURE AND PART NUMBER	(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION: DATE: REVISION: REV. DATE:
SCHEDULED MAINT. RQMT. TO BE DONE:		
CORRESPONDING MSI SEQUENCE NR.:		



MPA WORKSHEET 6 SUPPORTS THE MPA - THE RESULTS PERTINENT TO THE MAINT. PLAN ARE TRANSFERRED TO MPA WORKSHEET 5

<u>MPA WORKSHEET 6 INPUTS TO OTHER LOGISTIC ELEMENTS</u>

- SDLM AND MAINT. REQUIREMENT CARDS - ELAPSED TIME - SKILL LEVEL - SERVICES - SCHEDULED TASKS - MANPOWER - INSPECTION LIMITS - TEST REQUIREMENTS
- MAINTENANCE PUBLICATION TASKS
- TRAINING INPUTS - SKILL LEVEL - MANPOWER - TRAINING COURSES ON SCHEDULED MAINTENANCE REQUIREMENTS
- GSE INPUT - IDENTIFICATION OF GSE REQUIRED FOR SCHEDULED MAINTENANCE REQUIREMENTS PREPARATION/PROCESS/SECURE - ALSO ON MPA WORKSHEET 5

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MPA WORKSHEET 7 — **FAILURE CAUSES AND RESTORATIVE ACTION**

(a) SUBJECT	(b) WUC/LSACN	(c)	
MAINTENANCE PLAN CANDIDATE NOMENCLATURE AND PART NUMBER		PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:	DATE: REVISION: REV. DATE:

(d) ALL SEQ. NRS.	(e) FAIL MODE NR.	(f) CAUSES	(g) RESTORATIVE ACTION NR.	(g) RESTORATIVE ACTION ACTION	(h) PREDICTED % OF WRA FAILURES
		MPA WORKSHEET 7 INPUTS TO THE MAINT PLAN		CORR MAINT REQUIREMENTS PART III OF MAINT PLAN	MRF AND RPF INPUTS PART II OF MAINT PLAN

<u>MPA WORKSHEET 7 INPUTS TO OTHER LOGISTIC ELEMENTS</u>

SUPPLY SUPPORT - INPUT TO PIECE PART DETERMINATION - QUANTITY AND LOCATION
- INPUT TO SPARES DETERMINATION

MAINTENANCE PUBS - INPUTS TO CORRECTIVE MAINTENANCE - REQUIREMENTS AND MAINT. LEVEL

TRAINING - INPUT TO CORRECTIVE MAINT SKILLS - MANPOWER - TRAINING COURSES

MPA WORKSHEET 7 INPUT TO THE DEVELOPMENT PROGRAM

RELIABILITY IMPACT DETERMINATIONS
MAINTAINABILITY IMPACT DETERMINATIONS

MPA WORKSHEET 8 — **GSE/SM&R CODE DEVELOPMENT**

(a) SUBJECT	(b) WUC/LSACN	(c)
MAINTENANCE PLAN CANDIDATE NOMENCLATURE AND PART NUMBER		PREPARED BY: DATE: PREPARING ACTIVITY: REVISION: A/C APPLICATION: REV. DATE:

(d) ALL SEQ. NRS.	(e) FAIL MODE NR.	(f) FAULT ISOLATION TO: MAINT. LEVEL	(f) FAULT ISOLATION TO: GSE	(g) REMOVE/REPLACE AND/OR CHECK/TEST: MAINT. LEVEL	(g) REMOVE/REPLACE AND/OR CHECK/TEST: GSE	(h) RESTORATION OF: REST. ACT. NR.	(h) RESTORATION OF: MAINT. LEVEL	(h) RESTORATION OF: GSE
				SOURCE CODE INPUT POSI-TION 3 PART II OF MAINT PLAN			REPAIR LEVEL CORR MAINT REQMTS PART III OF MAINT PLAN	GSE REQ FOR CORR MAIN. REQMTS PART III OF MAINT PLAN
							SOURCE CODE INPUT POSI-TION 4 PART II OF MAINT PLAN	
							MRF AND RPF INPUTS PART II OF MAINT PLAN	

<u>MPA WORKSHEET 8 INPUTS TO OTHER LOGISTIC ELEMENTS</u>

MAINTENANCE PUBS - INPUTS TO CORRECTIVE MAINT. PUBS - MAINT LEVEL FOR FAULT ISOLATION, REMOVE/REPLACE AND RESTORATION.

GSE - INPUT TO GSE DETERMINATION FOR CORRECTIVE MAINT. BY MAINT. LEVEL

TRAINING - INPUTS TO SKILLS - MANPOWER - TRAINING COURSES BY MAINT. LEVEL FOR CORRECTIVE MAINTENANCE

MPA WORKSHEET 9			ECONOMIC LEVEL OF REPAIR ANALYSIS RESULTS				
(a) SUBJECT MAINTENANCE PLAN CANDIDATE NOMENCLATURE AND PART NUMBER			(b) WUC/LSACN	(c) PREPARED BY: PREPARING ACTIVITY: A/C APPLICATION:			DATE: REVISION: REV. DATE:
(d) SEQ. NR.	(e) PREDICTED FAILURE RATE	(f) PREDICTED COST	(g) PREDICTED REMOVAL RATE	(h) TOTAL LIFE CYCLE LOGISTICS COST BASED ON PREDICTIONS			
				REPAIR I ($)	REPAIR D ($)	SPLIT I ($)	DISCARD ($)
MPA WORK- SHEET 9 MAINT. PLAN IN- PUTS	MRF AND RPF INPUT PART II OF MAINT. PLAN	SOURCE CODE INPUT POSI- TION 5 PART II OF MAINT. PLAN					

MPA WORKSHEET 9 INPUTS TO OTHER LOGISTIC SUPPORT ELEMENTS

LOGISTICS LIFE CYCLE COST DETERMINATION INPUTS

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