Operator/Manufacturer Scheduled Maintenance

Volume 2 – Rotorcraft

Revision 2018.1

MSG-3

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ATA MSG-3 Volume 2 (Rotorcraft)

Operator / Manufacturer Scheduled Maintenance Development

Revision 2018.1

Airlines for America ®
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IMRBPB Acceptance Letter

International MRB Policy Board

10 April 2019

Mr. Mark Lopez

Director, Technical Operations Airlines for America

1275 Pennsylvania Ave NW Washington, DC 20004

Dear Mr. Lopez:

The International Maintenance Review Board Policy Board (IMRBPB) has reviewed the changes proposed to the Air Transport Association (ATA) Maintenance Steering Group – 3 (MSG-3) Report "Operator/Manufacturer Scheduled Maintenance Development", Volumes 1 and 2, Revision 2018.1.

The nine signatory agencies of the IMRBPB hereby accept ATA MSG-3 2018.1, Volume 1 and 2, for use as a guidance document in the development of future Maintenance Review Board Reports (or equivalent reports) within our respective regulatory structures.

Sincerely,

Raffaele Iovinella, Co-Chairman, IMRBPB, on behalf of

Richard T Perry, Chairman, IMRBPB

ENDORSEMENTS:

For the Civil Aviation Administration of China

XUE Shi Jun

Director, Aircraft Evaluation Division Flight Standards Department

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For the European Union Aviation Safety Agency

Raffaele Iovinella

Aircraft Maintenance Section Manager

For the Federal Aviation Administration (of the United States of America)

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Highlights

Prepared by:

Rotorcraft Maintenance Programs Industry Group

Release History

- Revision 2018.1 (November 2018)
- Revision 2015.1 (September 2015)
- Original Issue (October 2013)

Revision 2018.1 (Revised November 2018)

Location	Description of Change
All	See the Revision Summary for a complete description.

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Preface

Purpose

This document is based on ATA MSG-3 Volume 1 (Fixed Wing Aircraft) Revision 2018.1.

The purpose of the MSG-3 Volume 2 is to provide a methodology that is suitable for the development of scheduled maintenance requirements applicable to rotorcraft.

The MSG-3 Volume 2 has been developed by helicopter manufacturer specialists following attempts to implement ATA MSG-3 methodologies on rotorcraft designs.

Aside from differences in regulations (e.g. 14 CFR § 25 replaced by 14 CFR / CS / CAR Standard 29), the main challenge faced by the helicopter manufacturers was to adapt fixed wing airplane MSG-3 methodologies to components from the Rotors / Drive Systems.

Due to the rotary-wing concept, a number of components utilized in Rotors and Drive Systems provide significant load-carrying functions (flight loads, control loads) the failure of which could have an adverse effect on operating safety. The ATA MSG-3 procedures required some components from the Rotors / Drive Systems to be analyzed as both MSI's and SSI's. The ATA MSG-3 Volume 2 combined MSI and SSI analysis will produce applicable and effective tasks for Rotor / Drive Systems.

To enable the analysis of structural functions of the Rotors / Drive Systems, the Rotorcraft Maintenance Programs Industry Group (RMPIG) proposes the following:

- include relevant structural analysis steps in the Systems / Powerplant analyses of Rotors / Drive systems
- exclude Rotors / Drive Systems from [Section 2-4-1] "Aircraft Structure Defined"
- make modifications to ATA MSG-3 rendered necessary by these two modifications

The RMPIG members also propose the following:

- to amend the definition of "operating crew" to include "winch operators" and "radio operators" which are common to helicopters and whose duties are comparable to those of cabin attendant personnel, in that their functions include operational checks of aircraft systems
- to consider the effects of environmental deterioration of non-metallic structures
- to include "landing area debris" as a consideration for accidental damage since helicopters often land on and take off from unprepared surfaces.

All these issues lead to the elaboration of a MSG-3 Volume 2 (Rotorcraft) based on ATA MSG-3 Revision Volume 1 (Fixed Wing Aircraft) 2018.1.

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Differences between the ATA MSG-3 revision 2018.1 and the initial issue of the MSG-3 Volume 2 (Rotorcraft)

1. Consistency with ATA MSG-3

Every effort was made to maintain the same format, section breakdown and section numbering in the MSG-3 Volume 2 (Rotorcraft) as found in the ATA MSG-3 Volume 1 (Fixed Wing Aircraft) document Revision 2018.1. This was done to facilitate considerations for the applicability of future MPIG ATA MSG-3 proposals into the MSG-3 Volume 2 document.

2. Differences linked to Rotors / Drive systems

Differences linked to specific MSG-3 methodologies applicable to Rotors / Drive Systems include:

1. the addition of section **2-3-9. Supplemental analyses for Rotors / Drive systems** specific to load-carrying functions of MSI's from Rotors / Drive systems
2. the modification of the last sentence of section 2-2. to explain the new section 2-3-9. which cannot be used independently from other MSG-3 Volume 2 sections
3. the addition of Figure 2-3.1.
4. the addition of a fourth note at the end of section 2-3-1.1 (Step 1 of MSI selection)
5. change the text of the introductory paragraph of § 2-4-1. in order to make sure that items from Rotors / Drive systems are not considered as aircraft structure
6. the addition of the definition of Rotors / Drive systems in Appendix A – Glossary. This definition is identical to the definition found in the design basis (14 CFR / CS / CAR Standard 29) for transport category helicopters

3. Other differences

Other differences not linked to specific MSG-3 methodologies applicable to Rotors / Drive Systems include:

7. Wherever appropriate, the name MSG-3 has been replaced by MSG-3 Volume 2.
8. Wherever appropriate, ATA has been replaced by HAI.
9. Wherever appropriate, the term "Airline" has been deleted or replaced by "Operator".
10. Wherever appropriate, the term "Airplane" has been replaced by "Rotorcraft".
11. Wherever appropriate, airplane operations have been replaced by rotorcraft operations.
12. Wherever appropriate, 14 CFR § 25.1309 has been replaced by 14 CFR / CS / CAR § 29.1309.
13. Wherever appropriate, 14 CFR § 25.571 has been replaced by 14 CFR / CS / CAR § 29.571.
14. "Runway debris" has been replaced by "Runway or landing area debris" in sections dealing with accidental damage with SSI's and Rotor / Drive Systems.
15. In [Section 2-4-3.1] Damage Sources, the last sentence of paragraph 2-4-3.1 (b) has been

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modified to take into account susceptibility of non-metallic structures to degradation due to the environment.

16. The term “Cabin attendant personnel” has been replaced by “cabin personnel” in [Section 2-3-5.1] and in Appendix A.

17. The ATA MSG-3 Volume 1 (Fixed Wing Aircraft) document has been added to the list of reference documents in Annex

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Revision Summary

MSG-3 Volume 2, Revision 2015.1

The changes introduced in 2015 are:

1. Updated the definition of Corrosion Level 1 in accordance with the recommendation from the Airworthiness Assurance Working Group [0 Appendix A. Glossary] (IP 119 Rev 2_210415).
2. Removed statement in the Zonal Analysis Procedure regarding Zonal Transfer Guidance of GVI's determined by L/HIRF Analysis [2-5-1] (IP 137).
3. Deleted the Glossary term for L/HIRF Protection Systems as that term is no longer used in MSG-3 [0 Appendix A. Glossary] (IP 138).
4. Clarified that surface protection ratings should evolve over time [2-4-5] (IP 139).
5. Provided guidance to help in answering question 3 of level 1 Systems analysis for protective functions, in particular which combination of failures should be considered [2-3-5.3] (IP 140).
6. Provided additional guidance on handling of safe life items that might be affected by corrosion and subsequent premature failure [2-4-2.5],[2-4-2.6], [a] (IP 141).
7. Updated logic diagram titles for consistency [Fig_2-2.1], [Fig_2-4-4.1], [Figure 2-5-1.1], [Fig_2_6_1_3] (IP 142).
8. Clarified the distinction between Visual Check and Operational Check [2-3-7.2], [2-3-7.8], [0 Appendix A. Glossary] (IP 143).
9. Provided clarification of the policy permitting consolidation of tasks [2-3-7.7], [2-3-7.9], [0 Appendix A. Glossary] (IP 144).
10. Clarified that terms such as "occupant" or "on board" do not necessarily mean physically limited to the inside of the rotorcraft [2-3-5.2], [2-4-1.1], [0 Appendix A. Glossary] (IP 147).
11. Clarified the applicability of PSEs for normal category rotorcraft [2-4-1.1] (IP 148).
12. Provided clarification that the MRB Report should contain tasks only arising from the MSG-3 logic process [1-1] (IP 150).
13. Revised the Glossary definition of "Lightning/HIRF Significant Item" to clarify which L/HIRF structural components should be addressed as LHSIs [0 Appendix A. Glossary] (IP 151).
14. Provided clarification on which Effectiveness criteria should be considered for each Failure Effect Category. Also provided guidance on what is meant by "cost-effective" and "multiple failure" [2-3-6.3], [2-3-6.5], [2-3-7.1], [2-3-7.2], [2-3-7.3], [2-3-7.4], [2-3-7.5], [2-3-7.6], [2-3-7.8], [0 Appendix A. Glossary] (IP 152).
15. Clarified the meaning of "unacceptable degradation" for L/HIRF protection [2-6-1.3], [0 Appendix A. Glossary] (IP 155).

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The changes introduced in 2018 are:

1. Clarified L/HIRF analysis methodology with wording to ensure attention is given to assessment of L/HIRF protection provided to all systems and structural components required to maintain the inherent safety of the aircraft [2-6], [2-6-1.3] (IP157)

2. Removed references to non-scheduled and non-routine maintenance to eliminate confusion with MSG-3 Objective [1-1], [2-1-2.2], [2-1-2.3] (IP158)

3. Flowchart Figure 2-3.1-Clarification (IP159)

4. Clarified that sampling programs are not to be used to select initial tasks intervals larger than those that can be substantiated with available data [2-3-8.7] (IP162)

5. Clarified the structural analysis for landing gears including the need to add CPCP identifiers on tasks looking for corrosion irrespective of the Section in which they are placed [1-3-2], [2-4-2.5] (IP164)

6. Added statement that scheduled maintenance development shall not be unduly influenced by National Requirements [2-1-2.3] (IP169)

7. HUMS for credit (IP170)

8. Updated Structure logic to introduce significant changes. Fatigue Damage on PSE structure no longer part of MSG-3 logic. MSG-3 FD assessment limited to accessibility and feasibility evaluation in cases where stress office recommend a task for non-PSE structure [2-4], [2-4-1, 2, 3, 4], [Figures 2-4-4-1, 2, 3, 4, 5, 6] (IP171)

9. Added the need for the identification and recording of information to support task selection and to provide traceability of task requirements [2-1-2.3] (IP176)

10. Clarified that in both Systems and Structure logic application, a Special Detailed Inspection may be selected to detect wear damage within specified limits using a measuring tool [2-3-7], [2-4-2] (IP179)

11. Note from section 2.3.1-2 deleted, as it was not applicable on helicopters (IP181).

12. Added a statement to require that traceability is recorded of individual tasks that are subsequently consolidated [2-3-7-9] (IP182)

13. Addition of Corrosion Prevention (CP) tasks definition and requirements to existing CPCP for “other Structures” (IP183)

14. Correction of the transcription of ED in Supplemental analysis (IP184)

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Added text to drive a harmonized approach to assessment of pressurized cylinder failures and the consideration of the effectiveness of hydrostatic tests for the satisfaction of MSG-3 logic [2-3-4] (IP185)

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Chapter 1. General

1-1. Objective

It is the objective of this document to present a means for developing the scheduled maintenance tasks and intervals which will be acceptable to the regulatory authorities, the operators, and the manufacturers. The scheduled maintenance task and interval details will be developed by coordination with specialists from the operators, manufacturers, and the Regulatory Authority of the country of manufacture. Specifically, this document outlines the general organization and decision processes for determining scheduled maintenance requirements initially projected for the life of the aircraft and/or powerplant.

Initial scheduled maintenance tasks and intervals are specified in Maintenance Review Board (MRB) Reports. MSG-3 is intended to facilitate the development of initial scheduled maintenance. This document addresses the development of scheduled maintenance using the MSG-3 analysis procedure. The MRB Report should only contain tasks arising from the MSG-3 logic process. National requirements not derived from MSG-3 logic are not part of the MRB Report. Other non MSG-3 tasks may be submitted to the Industry Steering Committee for consideration for inclusion in the MRB Report only when justification can be provided.

1-2. Scope

For the purpose of developing an MRB report, MSG-3 Volume 2 (Rotorcraft) is to be used to determine initial scheduled maintenance requirements.

The analysis process allows scheduled tasks and intervals required to support all certificated operating capabilities of the aircraft (including specific rotorcraft relative operations (e.g. Cat A, WAAS Approaches, external load operations)

1-3. Organization

The organization to carry out the scheduled maintenance development for a specific type aircraft shall be staffed by representatives of the rotorcraft operators purchasing the equipment, the prime manufacturers of the airframe and powerplant, and the Regulatory Authority.

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1-3-1. Industry Steering Committee

The management of the scheduled maintenance development activities shall be accomplished by an Industry Steering Committee composed of members from a representative number of operators and representatives of the prime airframe and engine manufacturers. It shall be the responsibility of this committee to establish policy, set initial goals for scheduled maintenance check intervals, direct the activities of working groups or other working activity, carry out liaison with the manufacturer and other operators, prepare the final recommendations and represent the operators in contacts with the Regulatory Authority. The ISC should see that the MSG-3 process identifies 100% accountability for all Maintenance Significant Items (MSI's) and Structural Significant Items (SSI's), whether or not a task has been derived from the analysis.

The ISC should advise Maintenance Working Groups (MWG) to fully consider available Vendor Recommendations (VR) and accept them only if they are applicable and effective according to MSG-3 Volume 2 criteria.

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1-3-2. Working Groups

One or more Working Groups, consisting of specialist representatives from the participating operators, the prime manufacturer, and the Regulatory Authority, may be constituted. The Industry Steering Committee, alternatively, may arrange some other means for obtaining the detailed technical information necessary to develop recommendations for scheduled maintenance in each area. Irrespective of the organization of the working activity, written technical data must be provided that supports its recommendations to the Industry Steering Committee. After approval by the Industry Steering Committee, these analyses and recommendations shall be consolidated into a final report for presentation to the Regulatory Authority.

NOTE:	If separate Working Groups are constituted, means of cooperation need to be established to assess items that fall into both SSI and MSI definitions (landing gear, doors, etc.) If similar tasks are developed in the separate working groups, coordination between the working groups must occur to avoid task duplication (e.g., a reference to the other working group's task can be inserted in the analysis). However, when assessing the duplication of tasks, the intent of the tasks should be carefully considered in order to ensure that the expected degradations will be detected in a timely manner and that the monitoring and reporting of in-service issues is properly addressed.

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Chapter 2. Development of Scheduled Maintenance

2-1. General

It is necessary to develop scheduled maintenance for each new type of aircraft prior to its introduction into service.

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2-1-1. Purpose

The primary purpose of this document is to develop a proposal to assist the Regulatory Authority in establishing initial scheduled maintenance tasks and intervals for new types of aircraft and/or powerplant. The intent is to maintain the inherent safety and reliability levels of the aircraft. These tasks and intervals become the basis for the first issue of each operator's maintenance requirements to govern its initial maintenance policy. Initial adjustments may be necessary to address operational and/or environmental conditions unique to the operator. As operating experience is accumulated, additional adjustments may be made by the operator to maintain efficient scheduled maintenance.

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2-1-2. Approach

It is desirable, therefore, to define in some detail

a) The objectives of efficient scheduled maintenance.

b) The content of efficient scheduled maintenance.

c) The method by which efficient scheduled maintenance can be developed.

1. Scheduled Maintenance Objectives

The objectives of efficient aircraft scheduled maintenance are

a) To ensure realization of the inherent safety and reliability levels of the aircraft.

b) To restore safety and reliability to their inherent levels when deterioration has occurred.

c) To obtain the information necessary for design improvement of those items whose inherent reliability proves inadequate.

d) To accomplish these goals at a minimum total cost, including maintenance costs and the costs of resulting failures.

These objectives recognize that scheduled maintenance, as such, cannot correct deficiencies in the inherent safety and reliability levels of the aircraft. The scheduled maintenance can only prevent deterioration of such inherent levels. If the inherent levels are found to be unsatisfactory, design modification is necessary to obtain improvement.

2. Scheduled Maintenance Content

The content of the scheduled maintenance itself consists of a group of scheduled tasks to be accomplished at specified intervals. The objective of these tasks is to identify failures and to prevent deterioration of the inherent safety and reliability levels of the aircraft. The tasks in scheduled maintenance may include:

(1) Lubrication/Servicing (LU/SV or LUB/SVC)

(2) Operational/Visual Check (OP/VC or OPC/VCK)

(3) Inspection/Functional Check (IN*/FC or */FNC)

- General Visual Inspection (GV or GVI)
- Detailed Inspection (DI or DET)
- Special Detailed Inspection (SI or SDI)
- Scheduled Structural Health Monitoring (S-SHM)
- Scheduled Health and Usage Monitoring (S-HUM)

(4) Restoration (RS or RST)

(5) Discard (DS or DIS)

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An efficient program is one which schedules only those tasks necessary to meet the stated objectives. It does not schedule additional tasks which will increase maintenance costs without a corresponding increase in reliability protection.

3. Method for Scheduled Maintenance Development

This document describes the method for developing the scheduled maintenance. Scheduled maintenance will be developed via use of a guided logic approach and will result in a task-oriented program. The logic's flow of analysis is failure-effect oriented.

The development shall not be unduly influenced by National Requirements.

As part of the Scheduled maintenance development procedures, maintenance requirements will only be selected if they meet the applicability and effectiveness criteria as defined in this document. The ISC will define the information to be presented to the working group to support their task selection decision and to provide traceability of task requirements in the development of the supporting ICA. This information (e.g. task purpose, accesses, tools/GSE, main steps of the procedure, estimated elapsed time/labor hour, pass/fail criteria…) will be recorded in the MSG-3 analysis or referenced supporting documentation for tracking purposes.

Items that, after analysis, have no scheduled task specified, may be monitored by an operator's reliability program.7

Assumptions made during the analysis, that can result in a change to the analysis, are to be recorded.

- Assumptions applying to the program as a whole, and not only to an individual MSG-3 analysis, are to be documented in the appropriate "Policy and Procedures Handbook" or "User's Guide." As a minimum, this applies to statements concerning anticipated average annual utilization, the environments to be considered, and the operating capabilities to which the aircraft/powerplant is certificated.

- If an analysis is (partially or as a whole) based on design solutions not completely frozen, this should be recorded in the analysis.

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2-2. Divisions of MSG-3 Volume 2 Document

The working portions of MSG-3 Volume 2 are contained in the next four (4) sections. Systems/Powerplant, including components and APU's, are considered in [Section 2-3]. Aircraft Structures is considered in [Section 2-4], Zonal Inspections in [Section 2-5] and L/HIRF is considered in [Section 2-6]. Each section contains its own explanatory material and decision logic diagram (as appropriate); therefore, it may be used independently of other MSG-3 Volume 2 sections, except for [Section 2-3-9] which may not be used independently of [Section 2-3] and [Section 2-4].

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Figure 2-2.1 Systems/Powerplant MSG-3 Logic Diagram (Part 1 of 2)

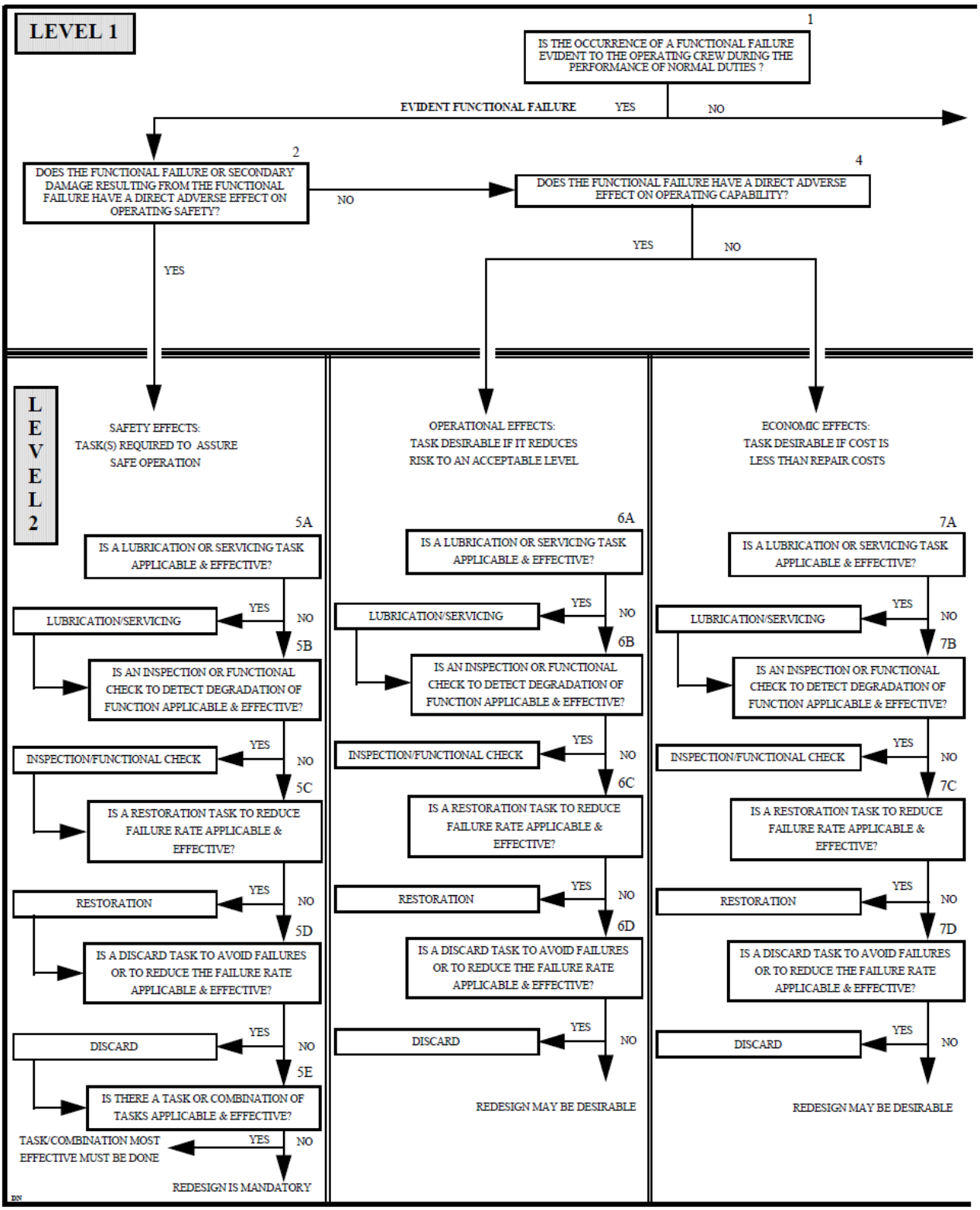

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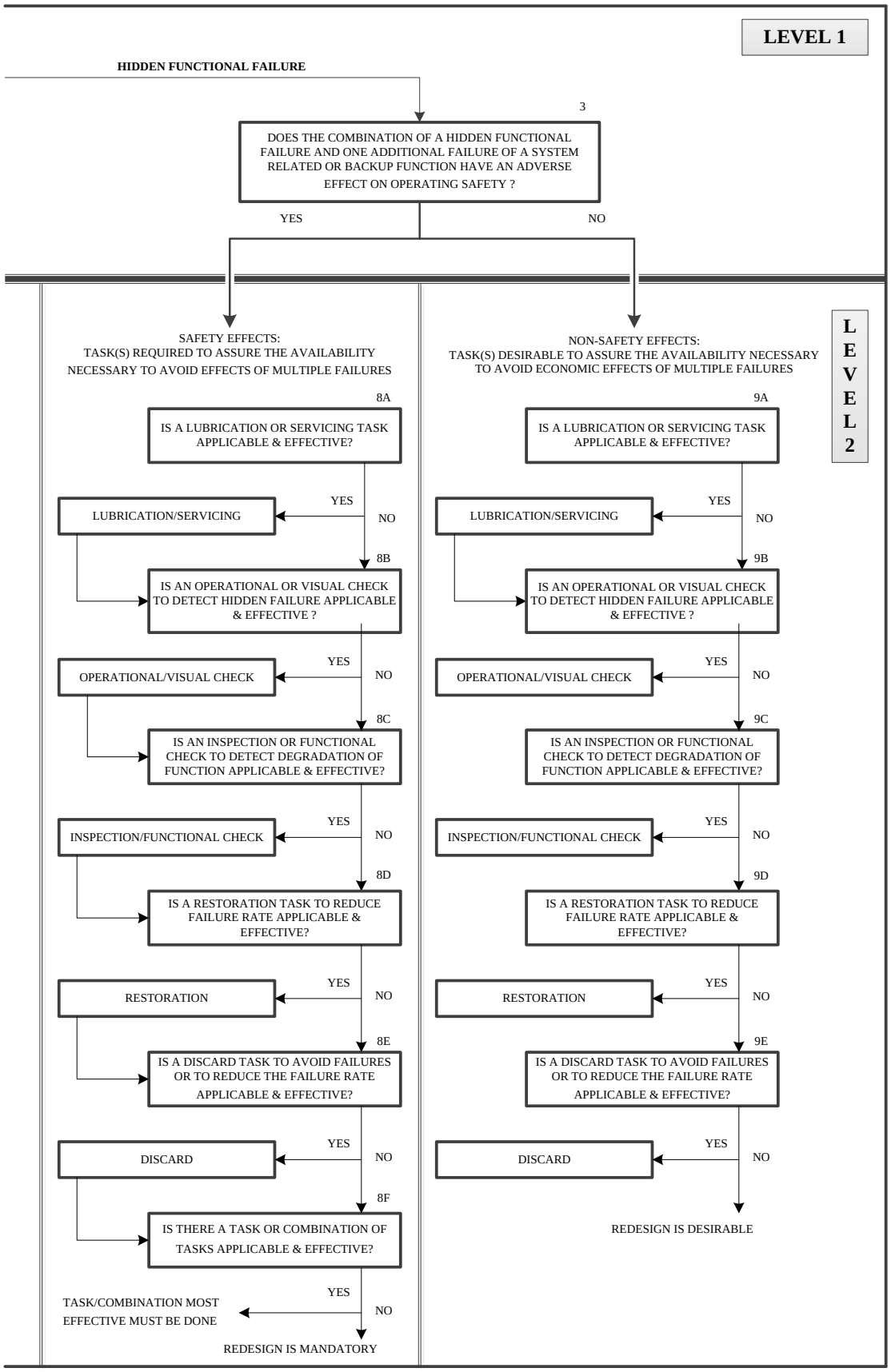
Figure 2-2.1 Systems/Powerplant MSG-3 Logic Diagram (Part 2 of 2)



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2-3. Aircraft Systems/Powerplant Analysis Procedure

The method for determining the scheduled maintenance tasks and intervals for systems/powerplant, including components and APU's, uses a progressive logic diagram. A glossary of terms and definitions used in the logic diagram is listed in Appendix A. This logic is the basis of an evaluation technique applied to each maintenance significant item (system, sub-system, module, component, accessory, unit, part, etc.), using the technical data available. Principally, the evaluations are based on the item's functional failures and failure causes.

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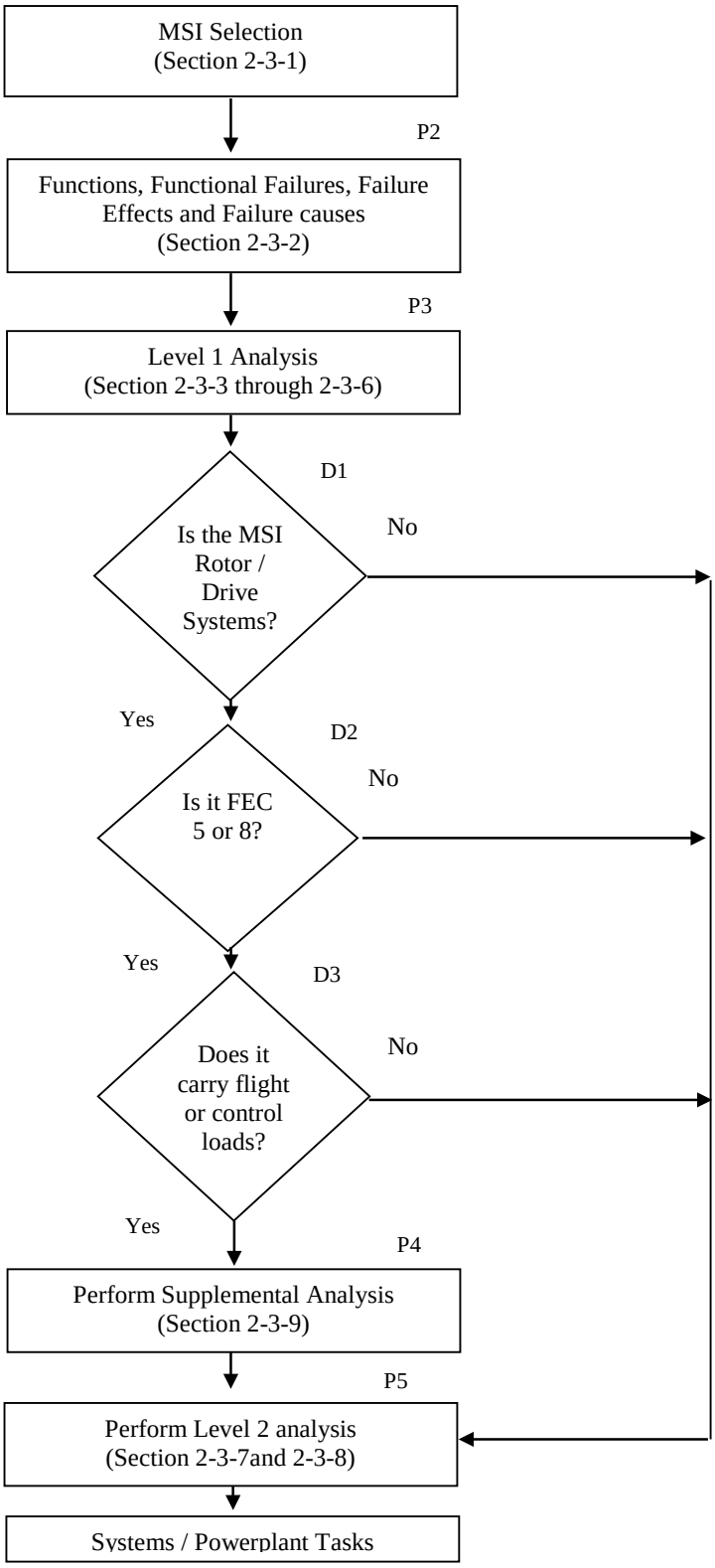
Figure 2-3.1 Systems/Powerplant Analysis Logic Diagram



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2-3-1. MSI Selection

Before the actual MSG-3 logic can be applied to an item, the aircraft's significant systems and components must be identified. The identification process shall not be influenced by National Requirements.

Maintenance Significant Items (MSIs) are items fulfilling defined selection criteria (see Step 3 below) for which MSI analyses are established at the highest manageable level.

This process of identifying Maintenance Significant Items is a conservative process (using engineering judgment) based on the anticipated consequences of failure. The top-down approach is a process of identifying the significant items on the aircraft at the highest manageable level.

The MSI selection process is outlined below:

1. Step 1.

The manufacturer partitions the aircraft into major functional areas; ATA Systems and Subsystems. This process continues until all on-aircraft replaceable components have been identified.

NOTE:	1. Structural items, whether designated as SSI or Other Structure, having system related functionality (e.g. firewalls, shields, integral fuel tank boundaries, flight control hinge bearings, drains, door hinges) need to be addressed in the MSI selection through coordination between Systems and Structures Working Groups in accordance with established transfer policies and procedures. 2. Except for those items within the Rotor / Drive systems ATA chapters (61 – 65) which should be analyzed using the dedicated process (Section 2-3-9) system components that contribute significantly to carrying flight, ground, pressure or control loads and whose failure could affect the structural integrity necessary for the safety of the aircraft should be analyzed in consultation with the Structures Working Group in accordance with established transfer policies and procedures. 3. All safety/emergency systems or equipment should also be included.

2. Step 2.

Using a top-down approach, the manufacturer establishes the list of items to which the MSI selection questions will be applied.

3. Step 3.

The manufacturer applies the following questions to the list of items identified in Step 2:

a) Could failure be undetectable or not likely to be detected by the operating crew during normal duties?

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b) Could failure affect safety (on ground or in flight), including safety/emergency systems or equipment?

c) Could failure have significant operational impact?

d) Could failure have significant economic impact?

4. Step 4.

a) For those items for which at least one of the four questions is answered with a "YES," MSG-3 Volume 2 analysis is required, and the highest manageable level must be confirmed (see Step 2, above). Consideration should be given to selecting a higher manageable level that includes this item as part of that higher-level system. An MSI is usually a system or sub-system, and is, in most cases, one level above the lowest (on-aircraft) level identified in Step 1. This level is considered the highest manageable level; i.e., one which is high enough to avoid unnecessary analysis, but low enough to be properly analyzed and ensure that all functions, functional failures and failure causes are covered.

b) For those items for which all four questions are answered with a "NO," MSG-3 Volume 2 analysis is not required and further MSI selection analysis is not necessary at lower levels. Additionally, the lower-level items should be listed to identify those that will not be further assessed. This list must be presented by the manufacturer to the ISC for review and approval.

5. Step 5.

Once the highest manageable level is confirmed per Step 4, the resulting list of items is now considered the "Candidate MSI List," and is presented by the manufacturer to the ISC. The ISC, in turn, reviews and approves this list for subsequent distribution to the Working Groups.

6. Step 6.

The Working Groups will review the Candidate MSI List, and through application of MSG-3 Volume 2 analysis, validate the selected highest manageable level or (if required) propose modification of the MSI list to the ISC. The primary aim of the Working Group review is to verify that no significant item has been overlooked, and that the right level for the analysis has been chosen.

NOTE:	Although an item may be selected as an MSI and will be analyzed, this does not imply that a task will necessarily result from the analysis.

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