Combined IP 92 & 103 text changes for MSG-3; Date 03 Apr 2009

Appendix A, Glossary section as follows:

[…]

Structural Health Monitoring (SHM)	The concept of checking or watching a specific structural item, detail, installation or assembly using on board mechanical, optical or electronic devices specifically designed for the application used. SHM does not name any specific method or technology.

[…]

Scheduled SHM (S-SHM)	S-SHM is the act to use/run/read out a SHM device at an interval set at a fixed schedule.

[…]

Para 2-1-2

2. Scheduled Maintenance Content

The content of the scheduled maintenance itself consists of two groups of tasks

a) A group of scheduled tasks to be accomplished at specified intervals. The objective of these tasks is 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)

(4) Restoration (RS or RST)

(5) Discard (DS or DIS)

[…]

2-4. Aircraft Structural Analysis Procedure

This section contains guidelines for developing scheduled maintenance tasks for aircraft structure. These are designed to relate the scheduled maintenance tasks to the consequences of structural damage remaining undetected. Each structural item is assessed in terms of its significance to continuing airworthiness, susceptibility to any form of damage, and the degree of difficulty involved in detecting such damage. Once this is established, scheduled structural maintenance can be developed which can be shown to be effective in detecting and preventing structural degradation due to fatigue, environmental deterioration, or accidental damage throughout the operational life of the aircraft. The structural maintenance task(s) developed as part

of the scheduled structural maintenance are used to satisfy aircraft type certification and MRB requirements.

Mandatory replacement times for structural safe-life parts are included in the Airworthiness Limitations, required by the regulatory authorities as part of the Instructions for Continued Airworthiness. Some of the items requiring fatigue related inspections may also be included, as well as specific Corrosion Prevention and Control Program (CPCP) tasks which subsequently warrant inclusion, based on the in-service experience of the operators.

Requirements for detecting **Accidental Damage (AD)**, **Environmental Deterioration (ED)**, **Fatigue Damage (FD)**, and procedures for preventing and/or controlling corrosion form the basis for the MRB structural maintenance.

However, all FD inspection requirements may not be available when the aircraft enters service. In such cases the manufacturer shall propose, prior to the entry of the aircraft into service, an appropriate time frame for completing the FD inspection requirements.

If the need arises, procedures should be developed for any new material (e.g., new composite material) whose damage characteristics do not follow those procedures described in this document

2-4-1. Aircraft Structure Defined

Aircraft structure consists of all load carrying members including wings, fuselage, empennage, engine mountings, landing gear, flight control surfaces and related points of attachment. The actuating portions of items such as landing gear, flight controls, doors, etc. will be treated as systems components and will be analyzed as described in [Section 2-3]. The attachment fittings of the actuators to the airframe will be treated as structure, while the dynamic components such as hinge bearings will be treated as System components. Structure-to-structure attach points, not otherwise associated with an aircraft system (e.g., pylon attach fittings and diagonal braces) that feature bearings will be treated as structure. However, since the Structural Analysis Procedure may not provide appropriate tasking for maintaining such attach points, this information should be coordinated with the appropriate Systems Working Group in accordance with established transfer policy and procedures.

1. Significant and Other Structure

Structure can be subdivided into items according to the consequences of their failure to aircraft safety as follows

a. A **Structural Significant Item (SSI)** is any detail, element or assembly, which contributes significantly to carrying flight, ground, pressure or control loads, and whose failure could affect the structural integrity necessary for the safety of the aircraft.

   SSIs must not be confused with Principal Structural Elements, PSE (FAR 25.571); however, all PSEs must be addressed by the SSIs.

b. **Other Structure** is that which is judged not to be a Structural Significant Item. It is defined both externally and internally within zonal boundaries.

2-4-2. Scheduled Structural Maintenance

The primary objective of the scheduled structural maintenance is to maintain the inherent airworthiness throughout the operational life of the aircraft in an economical manner. To achieve this, the inspections must meet the detection requirements from each of the AD, ED and FD assessments. Where applicable, other sources of damage/deterioration, such as wear, are to be considered when establishing scheduled

maintenance requirements. Full account may be taken of all applicable inspections occurring in the fleet.

AD and ED analysis is done by means of an assessment based on a rating system, as described in 2-4-5. FD analysis (as part of the MRB process) is an accessibility and feasibility evaluation of the damage tolerant assessment, as described in Figure 2-4-4-6.This evaluation can be done based on a rating system as described in 2-4-5.

Inspections related to detection of AD/ED are applicable to all aircraft when they first enter service. Changes or adjustments can be made to these inspections based on individual operator experience, when approved by their local regulatory authority.

Additional maintenance tasks (related to ED in metallics) to control corrosion to Level 1 or better are applicable at a threshold which is established during the aircraft type certification process. These are based on manufacturer and operator experience with similar aircraft structure, taking into consideration differences in relevant design features e.g. choice of material, assembly process, corrosion protection systems, galley and toilet design etc. See also [Heading 2-4-2.5] entitled Corrosion Prevention and Control Program.

Non-metallic structure is susceptible to damage and/or deterioration (e.g., disbonding and delamination). Such structure that is classified as an SSI will require inspections to ensure adequate strength throughout its operational life. Susceptibility to long term deterioration is assessed with regard to the operating environment. Areas such as major attachments, joints with metallic parts and areas of high stress levels are suggested as likely candidates for inspection.

Inspections related to FD detection in metals are applicable after a threshold, which is established during the aircraft type certification process. At the time the fatigue related inspections are implemented, sampling can be used, where it is applicable and effective. The fatigue related inspections are based ~~directly~~ on the manufacturer's approved damage tolerance evaluations and changes or adjustments by the operators require use of an approved procedure.

Deleted: directly

Inspections related to FD detection in non-metals may not be required as their design is based on a "no-damage growth" design philosophy, and substantiated by testing.

Where no service experience exists with similar structure, the structural maintenance requirements shall be based on manufacturer's recommendations.

Proposed initial scheduled maintenance tasks, to be used as the basis for the structural maintenance, are established for each aircraft type by the Industry Steering Committee on the basis of:

a. Operator experience

b. Manufacturer's proposals

c. Considerations of systems analysis requirements

1. Structural Maintenance Tasks

As part of the structural maintenance development procedure, applicable and effective structural maintenance tasks are selected for each deterioration process of the SSI. To assure a direct correlation between the structural damage tolerance evaluations and the structural maintenance, it is necessary to describe each task.

To all extents possible, the inspection methods specified in the tasks should use the standard set of definitions included in the MSG-3 glossary. Changes and/or additions to the inspection methods and definitions must be approved by the Industry Steering Committee.

Emerging technology, such as SHM may be an option to check or watch for Accidental Damage (AD), Environmental Deterioration (ED) and /or Fatigue Damage (FD) where demonstrated to be applicable and effective. For the time being, MSG-3 only takes into account Scheduled SHM (S-SHM).
Dedicated analysis procedures need to be developed and approved/accepted at the level of the PPH for such technology.

2. Inspection Thresholds

The inspection threshold for each SSI inspection task is a function of the source of damage as follows:

a. **Accidental Damage -** The first inspection (threshold) for accidental damage normally corresponds to a period equal to the defined repeat inspection interval, from the time of first entry into service.

b. **Environmental Deterioration** - The initial inspection thresholds for all levels of inspection are based on existing relevant service experience, manufacturers recommendations, and/or a conservative age exploration process.

c. **Fatigue Damage** - Inspections directly related to fatigue damage detection will occur after a threshold(s) to be established by the manufacturer and approved by the appropriate regulatory authority. Thresholds are normally established as part of the damage tolerance certification requirements. These are subject to change as service experience, additional testing, or analysis work is obtained.

3. Repeat Inspection Intervals

After each inspection has been conducted, the repeat interval sets the period until the next inspection:

a. **Accidental Damage -** The repeat interval should be based on operator and manufacturer experience with similar structure. Selected intervals will normally correspond to single or multiple levels of the scheduled maintenance check intervals.

b. **Environmental Deterioration** - The repeat interval for detection/prevention/control of ED (corrosion, stress corrosion, delamination, disbonding, etc.) should be based on existing relevant service experience and/or manufacturers recommendations.

c. **Fatigue Damage -** The repeat intervals for fatigue related inspections are based on the damage tolerance evaluations. These are used to demonstrate that applicable and effective inspections provide sufficient probability of detecting fatigue damage for each SSI.

4. Fatigue Related Sampling Inspections

Transport aircraft with the highest number of flight cycles are most susceptible to initial fatigue cracking in the fleet. This means that adequate inspections on such aircraft will provide the greatest benefits for timely detection of fatigue damage. Such sampling inspections are developed on the basis of appropriate statistical variables, including:

a. The number of aircraft inspected.

b. The inspection methods and repeat intervals.

c. The number of flight cycles completed.

A list of SSIs that are suitable for a fatigue related sampling inspections will be established by the Structures Working Group and submitted to the Industry Steering Committee for approval and inclusion in the MRB report proposal. Full details of the fatigue related sampling inspections will be established by a joint operator/ manufacturer task force, based on the manufacturer's technical evaluations, prior to aircraft

exceeding the fatigue damage threshold(s).

5. Corrosion Prevention and Control Programs (CPCP)

A Corrosion Prevention and Control Program should be established to maintain the aircraft's resistance to corrosion as a result of systematic (e.g. age related) deterioration through chemical and/or environmental interaction.

The program is expected to allow control of the corrosion on the aircraft to **Corrosion Level 1** or better. The CPCP should be based on the ED analysis, assuming an aircraft operated in a typical environment. If corrosion is found to exceed Level 1 at any inspection time, the corrosion control program for the affected area must be reviewed by the operator with the objective to ensure Corrosion Level 1 or better.

6. Age Exploration Program

An age exploration program may be desirable to verify the aircraft's resistance to corrosion deterioration before the Corrosion Prevention and Control Program Task Thresholds.

To improve on the specific task intervals for non-metallic significant structure, an age exploration program may be desirable to verify the rate of structural deterioration.

Guidelines for age exploration should be established by the Structures Working Group and submitted to the Industry Steering Committee for approval and inclusion in the scheduled structural maintenance tasks and intervals.

7. Zonal Inspections

Some parts of the inspection requirements for SSIs and most of the items categorized as Other Structure can be provided by the zonal inspections (Ref. [Section 2-5]).

Tasks and intervals included in the zonal inspections should be based on operator and manufacturer experience with similar structure. For structure containing new materials and/or construction concepts, tasks and intervals may be established based on assessment of the manufacturer's recommendations.

8. Inspection Results

The type certificate holder (manufacturer) and the operators will implement a satisfactory system for the effective collection and dissemination of service experience from the scheduled structural maintenance.

This process will supplement the system which is required by existing regulations for reporting occurrences of failures, malfunctions or defects (e.g. Service Difficulty Reports).

2-4-3. Damage Sources and Inspection Requirements

This section describes the damage sources and inspection requirements to be considered when developing the scheduled structural maintenance.

1. Damage Sources

The assessment of structure for the selection of maintenance tasks should consider the following damage sources

a. **Accidental Damage (AD)**, which is characterized by the occurrence of a random discrete event which may reduce the inherent level of residual strength. Sources of such damage include ground and cargo handling equipment, foreign objects, erosion from rain, hail, lightning, runway debris, spillage, freezing, thawing, etc., and those resulting from human error during aircraft manufacture, operation or maintenance that are not included in other damage sources.

   The same sources of accidental damage as those considered for metallic materials are to be considered for non-metallic material such as composites. The consequence of a damage may not be readily apparent and may include internal damage, e.g., disbonding or delamination.

   Large size accidental damage, such as that caused by engine disintegration, bird strike or major collision with ground equipment, will be readily detectable and no maintenance task assessment is required.

b. **Environmental Deterioration (ED)**, which is characterized by structural deterioration as a result of a chemical interaction with its climate or environment. Assessments are required to cover corrosion, including stress corrosion, and deterioration of non-metallic materials. Corrosion may or may not be time/usage dependent. For example, deterioration resulting from a breakdown in surface protection is more probable as the calendar age increases; conversely, corrosion due to galley spillage is a randomly occurring discrete event.

   Stress corrosion cracking in a given environment is directly dependent upon the level of sustained tensile stress which may result from heat treatment, forming, fit-up, or misalignment.

   In contrast to the environmental deterioration process of metallic structures, non-metallic structures such as composites are not normally susceptible to degradation due to the environment. However, the effect of long-term aging in an operating environment has to be taken into consideration when developing the structural maintenance.

c. **Fatigue Damage (FD)** which is characterized by the initiation of a crack or cracks due to cyclic loading and subsequent propagation. It is a cumulative process with respect to aircraft usage (flight cycles or flight hours).

2. Inspection Requirements

Inspection requirements in relation to the damage sources are as follows:

a. **Accidental Damage (AD)**, stress corrosion and some other forms of corrosion are random in nature and can occur any time during the aircraft service life. In such cases, inspection requirements apply to all aircraft in the fleet throughout their operational lives.

b. Most forms of corrosion are time/usage dependent and more likely to occur as the fleet ages. In such cases, operator and manufacturer experience on similar structure can be used to establish appropriate maintenance tasks (including CPCP tasks) for the control of environmental deterioration.

   The deterioration of non-metallic structures such as composites has to be taken into consideration when establishing maintenance tasks. Appropriate inspection levels and frequencies should be based on existing relevant service experience and manufacturer's recommendations.

c. Detectable size fatigue cracking is not normally anticipated in primary airframe structure until the fleet has matured. Thereafter, scheduled structural maintenance may require revision.

   For most transport aircraft structure, aircraft with the highest number of flight cycles are more susceptible to initial fatigue cracking in the fleet and are suitable candidates for a fatigue related sampling, should this be applicable and effective.

2-4-4. Scheduled Structural Maintenance Development

The scheduled structural maintenance tasks and intervals are based on an assessment of structural design information, fatigue and damage tolerance evaluations, service experience with similar structure and pertinent test results.

The assessment of structure for selection of maintenance tasks should include the following

a. The sources of structural deterioration:

   1. Accidental Damage

   2. Environmental Deterioration

   3. Fatigue Damage

b. The susceptibility of the structure to each source of deterioration.

c. The consequences of structural deterioration to continuing airworthiness

   1. Effect on aircraft (e.g. loss of function or reduction of residual strength).

   2. Multiple site or multiple element fatigue damage.

   3. The effect on aircraft flight or response characteristics caused by the interaction of structural damage or failure with systems or powerplant items.

   4. In-flight loss of structural items.

d. The applicability and effectiveness of various methods of preventing, controlling or detecting structural deterioration, taking into account inspection thresholds and repeat intervals.

e. Details of any SHM applications proposed by manufacturer.

1. Procedure

The procedure for developing structural maintenance tasks is shown in the logic diagram (Ref. [Figure 2-4-4.1]) and described by a series of process steps (P1, P2, P3, etc.) and decision steps (D1, D2, D3, etc.) as follows:

a. The structural maintenance analysis is to be applied to all aircraft structure which is divided into zones or areas (P1) and structural items (P2) by the manufacturer.

b. The manufacturer categorizes each item as structurally significant (SSI) or Other Structure, on the basis of the consequences to aircraft safety of item failure or malfunction (D1).

c. The same procedure is repeated until all structural items have been categorized.

d. Items categorized as Structural Significant Item (SSI) (P3) are listed as SSI's. They are to be categorized as safe-life or damage-tolerant (D5), and are additionally subjected to AD/ED/CPCP analysis (either as metallic or non-metallic structure).

e. Items categorized as Other Structure (P4) are compared to similar items on existing aircraft (D2). Maintenance recommendations are developed by the Structures Working Group (SWG) for items which are similar and by the manufacturer for those which are not, e. g., new materials or design concepts (P5). All tasks selected by the SWG (P6) are included in the scheduled structural maintenance (P20).

f. The manufacturer must consider two types of AD/ED analysis; for metallic structure (P7-P9) and for non-metallic structure (P10-P14). Each SSI may consist of one or the other, or both.

g. Inspection requirements for timely detection of Accidental Damage (AD) and Environmental Deterioration (ED) are determined for all metallic SSIs (P7). These can be determined for individual SSIs or groups of SSIs which are suitable for comparative assessments on the basis of their location, boundaries, inspection access, analysis breakdown, etc. The manufacturer's rating systems (Ref. [Subject 2-4-5]) are used to determine these requirements. The manufacturer may propose a validated S-SHM application(s) as long as it satisfies the detection requirement(s).

h. For each SSI containing metallic structure, the maintenance requirements are determined (P8) such that the expectations of the CPCP (Ref. [Heading 2-4-2.5]) are fulfilled.

i. The inspection requirement of the ED analysis is compared with the requirement of the CPCP (D3). If they are similar or identical, the ED task will cover the CPCP requirement. If the CPCP task requirement is not met, the ED task has to be reviewed and/or additional and separate CPCP tasks have to be determined (P9).

j. The process (P7, P8, P9) is repeated until all metallic SSIs are examined.

k. Each SSI containing non-metallic structure is assessed as to its sensitivity to Accidental Damage (AD) or not (D4), on the basis of SSI location, frequency of exposure to the damage source, and location of damage site.

l. SSIs containing non-metallic structure classified as sensitive to Accidental Damage (AD), are assessed for frequency of exposure to each likely damage source and the likelihood of multiple occurrence (P10), and its impact on the Environmental Deterioration (ED) analysis (P11).

m. When applicable, AD impact on the ED analysis is considered when the SSI is assessed for sensitivity to structural composition (P12) and sensitivity to the environment (P13), considering the material type.

n. Inspection requirements for timely detection of damage (e.g., delamination and disbonding) are determined for all SSIs containing non-metallic structure (P14). The manufacturer's rating systems (Ref.[Subject 2-4-5]) are used to determine these requirements. The manufacturer may propose a validated S-SHM application(s) as long as it satisfies the detection requirement(s).

o. All tasks resulting from AD/ED analysis (Figure 2-4-4.3 and/or Figure 2-4-4.4), including S-SHM tasks selected by the SWG, are included in the structural maintenance (P20).

p. The manufacturer categorizes each SSI as damage tolerant or safe-life (D5).

q. For each item categorized as safe-life, the manufacturer determines the safe-life limit (P15) which is included in the aircraft Airworthiness Limitations (P19). No fatigue related inspection is required to assure continuing airworthiness.

r. All remaining SSIs are damage tolerant and the manufacturer determines if timely detection of fatigue damage is dependent on scheduled inspections (P16).Scheduled fatigue related inspection may not be required for SSIs designed to carry the required load with damage that will be readily detectable during routine operation of the aircraft (D6).

~~s. Visual inspections during appropriate scheduled maintenance checks are used, where applicable and effective, to provide the necessary fatigue damage detection opportunities (D7).~~

~~t. Applicable nondestructive inspection (NDI) methods, during appropriate scheduled maintenance checks, are used to provide necessary fatigue damage detection opportunities when visual inspections are inadequate (D8).~~

~~u~~s. Details of the fatigue related ~~inspection~~ task requirements based on manufacturer's ~~approved~~ damage tolerance evaluations, including validated S-SHM application(s), are presented to the SWG (or equivalent body) who determines if they are ~~feasible~~ acceptable (~~D9~~ D7).

t. Improved ~~inspection access~~ task requirements (change in task type – visual inspections, non-destructive inspections, S-SHM – and/or access and/or procedure) and/or redesign of the SSI may be required ~~if no practical and effective visual and/or nondestructive inspections are available~~ (~~D10~~ D8, ~~P17~~). If this is not feasible for the manufacturer, the SSI must be categorized as safe-life (~~P15,~~ P17).

~~v~~u. Fatigue related ~~inspection~~ task requirements are listed (P18).

~~w. The FD analysis procedure is repeated for all damage tolerant SSIs.~~

~~x~~v. To support Type Certification, selected FD requirements associated with PSEs (D5) should be listed in the Airworthiness Limitations document.

~~y~~w. Tasks from AD, ED, FD (other than Airworthiness Limitations), and other structure analyses are listed in the Scheduled Structural Maintenance (P20).

~~z~~x. The resulting maintenance requirements for all structure from step "~~y~~w"- are submitted to the ISC for approval and inclusion in the MRB report proposal.

~~aa~~y. The structural maintenance portion of the Airworthiness Limitations should be included in a separate document and submitted to the appropriate Regulatory Authority (certification) for approval.

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Figure 2-4-4.1. Structural Logic Diagram

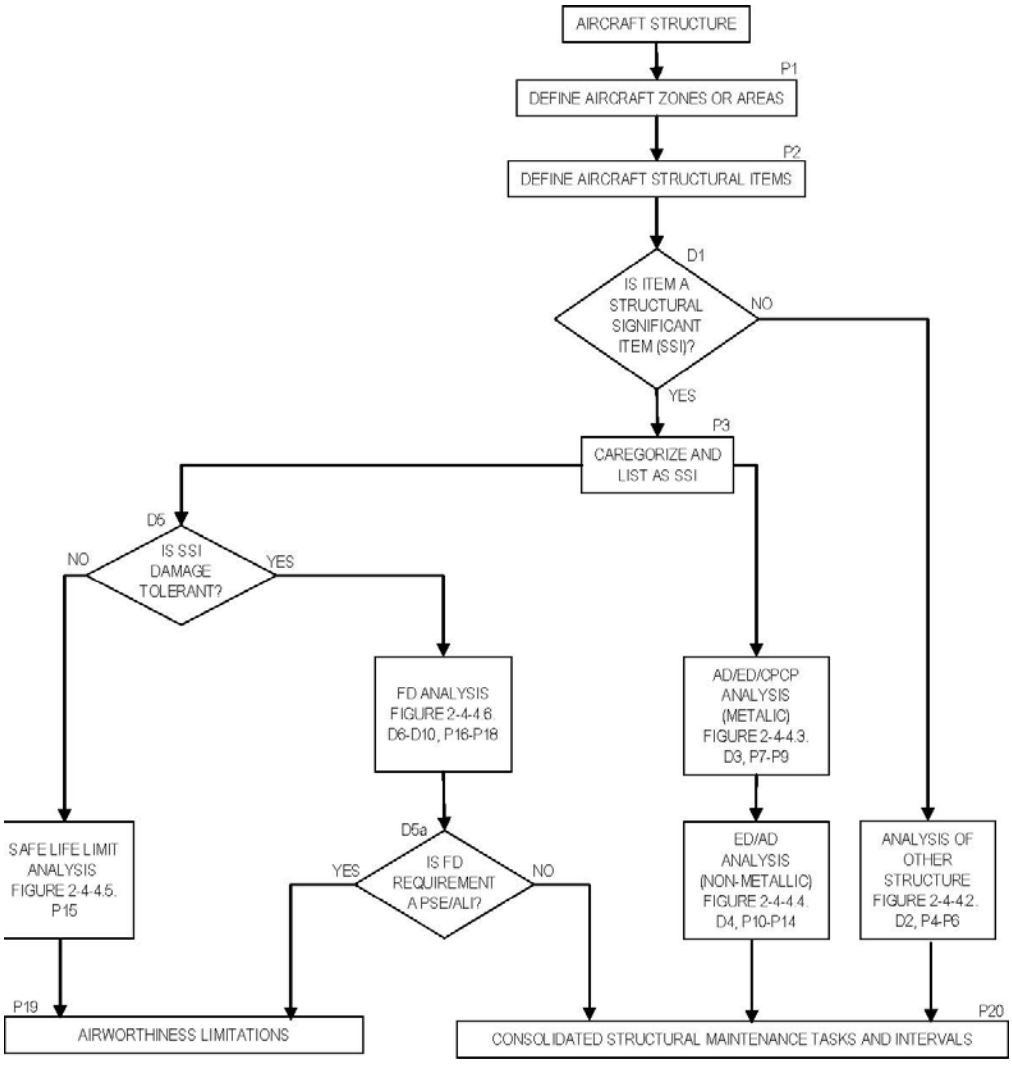


Figure 2-4-4.2. Other Structure Logic Diagram

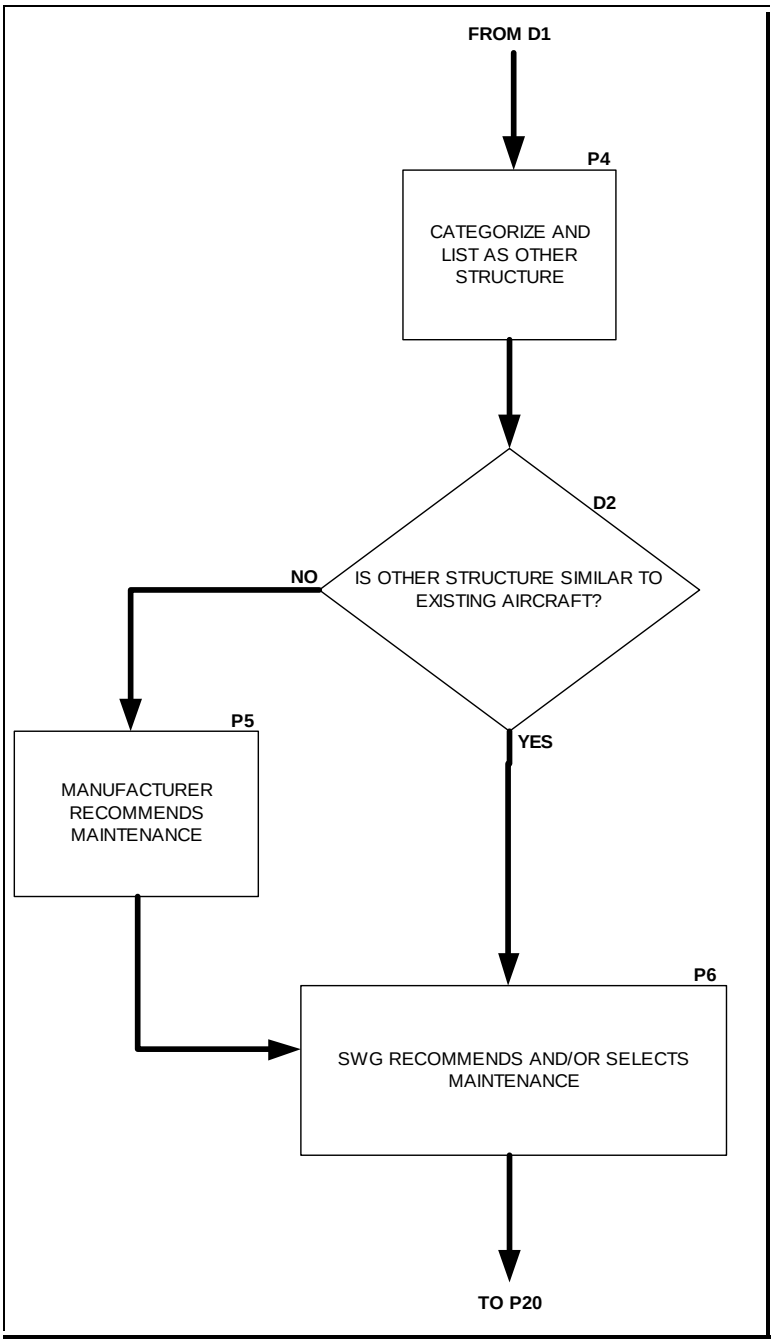


Figure 2-4-4.3. Accidental Damage and Environmental Deterioration (Metallic) Logic Diagram

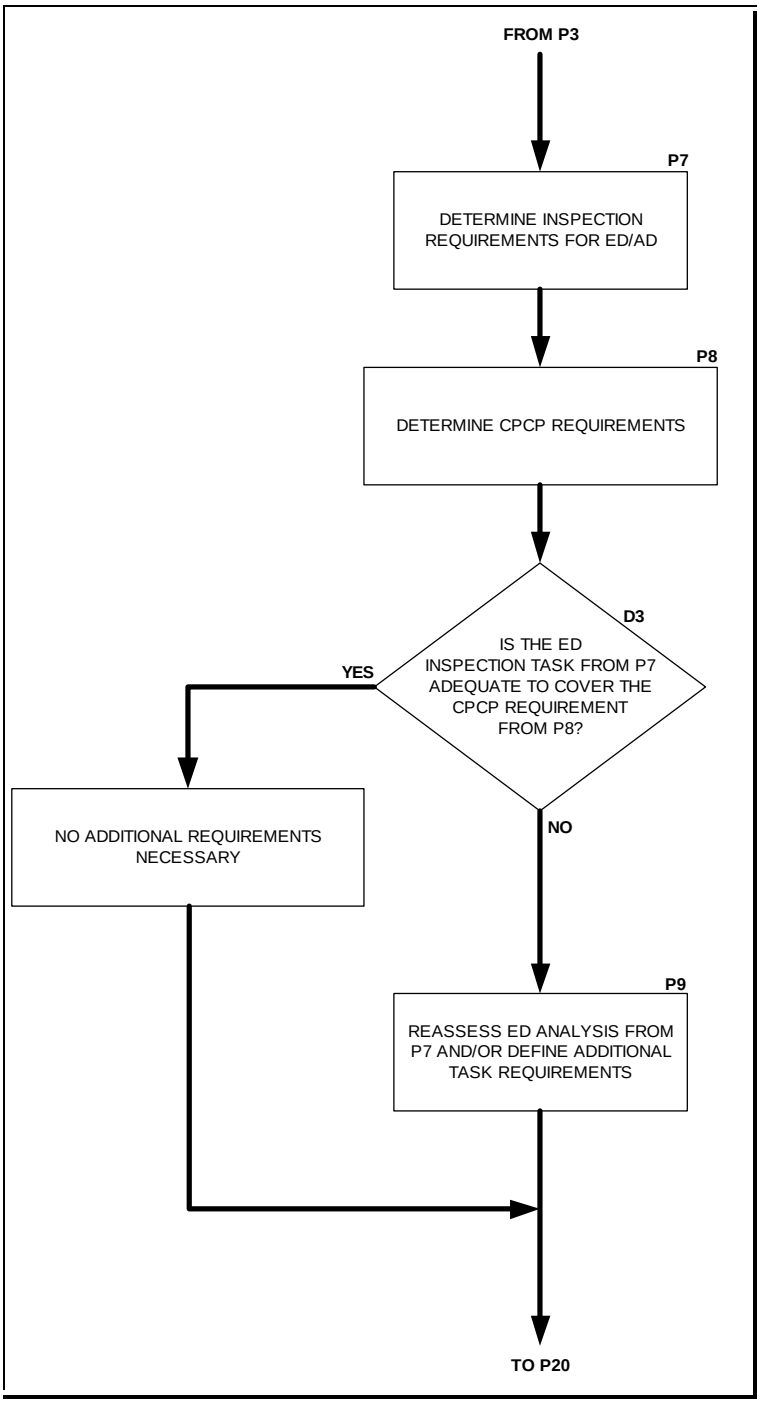


Figure 2-4-4.4. Accidental Damage and Environmental Deterioration (Non-Metallic) Logic Diagram

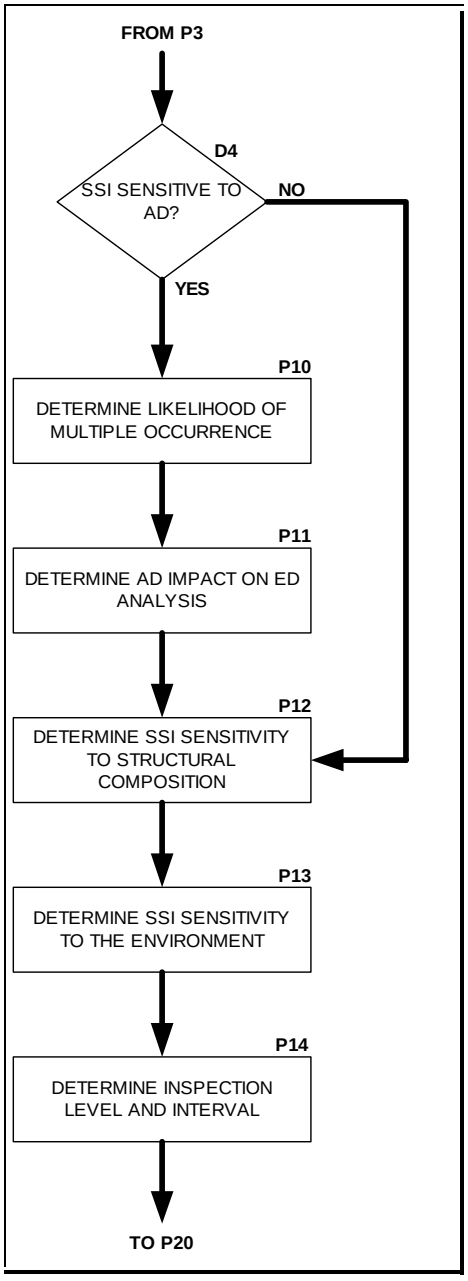


Figure 2-4-4.5. Safelife Limit Analysis Logic Diagram

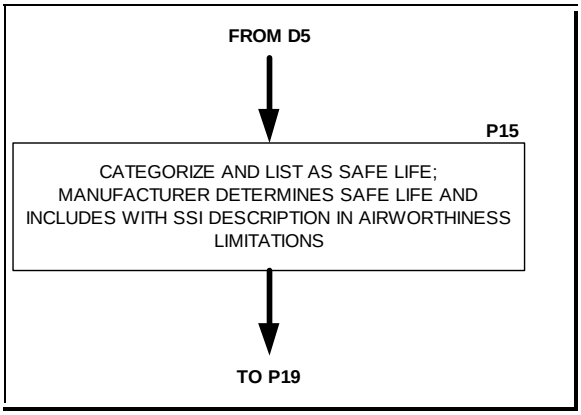
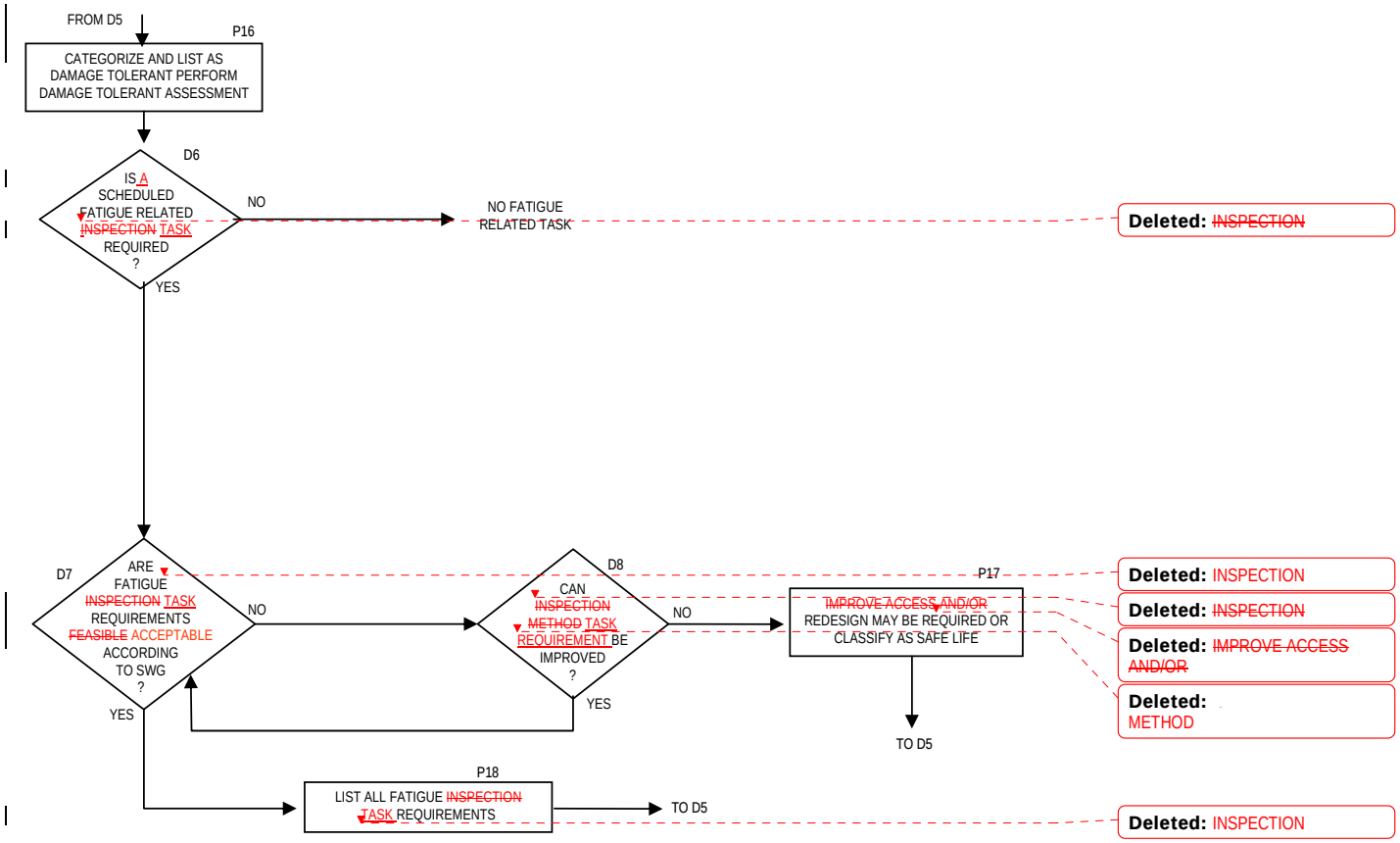


Figure 2-4-4.6. Fatigue Damage Analysis Logic Diagram



2-4-5. Rating Systems for Structural Significant Items

As part of the scheduled structural maintenance development, it is necessary to rate each Structural Significant Item in terms of susceptibility (likelihood of damage) and detectability (timely detection of damage). This section provides guidelines to assist manufacturers in the development of suitable rating systems. The rating system should account for the susceptibility of the SSI to the likely source of damage and the likely type of deterioration of the SSI due to the damage source. Differences between metallic and non-metallic portions of the SSI's must be taken into account.

The scheduled structural maintenance tasks and intervals are developed on the basis of requirements to assure timely detection of Accidental Damage and, Environmental Deterioration, and Fatigue Damage. Rating systems for AD and ED should be compatible to allow comparative assessments for each group of SSIs. Emphasis is placed on rating each SSI in relation to other SSIs in the same inspection area, leading to increased inspection emphasis for the most critical SSIs. Manufacturer and operator experience is a key ingredient for these evaluations.

If rating systems for FD of metals are used, they should evaluate only the detectability of damage. The FD susceptibility should be only evaluated by the Damage Tolerant Analysis. ~~Rating systems for FD of metals should incorporate results from the manufacturer's residual strength and crack growth evaluations.~~ Where required, rating systems for FD of non-metals should incorporate results from manufacturer's approved tests. The applicability and effectiveness of various inspection methods, detectable damage sizes and access requirements are key ingredients for these evaluation**s.**

Deleted: Rating systems for FD of metals should incorporate results from the manufacturer's residual strength and crack growth evaluations.

1. Rating Accidental Damage

Accidental damage rating systems should include evaluations of the following

a. Susceptibility to minor (not obvious) accidental damage based on frequency of exposure to and the location of damage from one or more sources, including:

   1. Ground handling equipment
   2. Cargo handling equipment
   3. Those resulting from human error during manufacture, maintenance, and/or operation of the aircraft, that are not included in other damage sources.
   4. Rain, hail, etc.
   5. Runway debris
   6. Lightning strike
   7. Water entrapment

b. Residual strength after accidental damage, normally based on the likely size of damage relative to the critical damage size for the SSI.

c. Timely detection of damage, based on the relative rate of growth after damage is sustained and visibility of the SSI for inspection. Assessments should take into account damage growth associated with non-chemical interaction with an environment, such as disbond or delamination growth associated with a freeze/thaw cycle.

Rating values should be assigned to groups of SSIs in the same inspection area on the basis of comparative assessments within the group.

2. Rating Environmental Deterioration (metals)

Environmental deterioration rating systems should allow for evaluations of susceptibility to and timely detection of corrosion and stress corrosion.

Susceptibility to corrosion is assessed on the basis of probable exposure to an adverse environment and adequacy of the protective system. For example:

a. Exposure to a deteriorating environment such as cabin condensation, galley spillage, toilet spillage, cleaning fluids, etc.

b. Contact between dissimilar materials (potential for galvanic activity).

c. Breakdown of surface protection systems; for example, deterioration of paint, primer, bonding, sealant, corrosion inhibiting compounds and cladding systems with the resulting corrosion of metallic materials or fluid incursion into permeable non-metallic materials, etc.

Material characteristics, coupled with the likelihood of sustained tensile stress, are used to assess susceptibility to stress corrosion.

Timely detection is determined by sensitivity to relative size of damage and visibility of the SSI for inspection.

NOTE:	Rating system evaluations should be made taking into account the requirement for each operator to control the aircraft structure at corrosion Level 1 or better.

3. Rating Environmental Deterioration (non-metals)

Environmental deterioration rating systems should allow for evaluations of susceptibility to, and timely detection of, structural deterioration (e.g., delamination and disbonding).

Susceptibility to deterioration (e.g., loss of stiffness) is assessed on the basis of materials subjected to environmental sources and the adequacy of the protective system. For example:

a. Aramind Fiber Reinforced Plastic (AFRP, also known as Kevlar) is sensitive to Ultra-Violet (UV) light, moisture and other fluids, when directly exposed.

b. Glass Fiber Reinforced Plastic (GFRP) may undergo long term degradation when directly exposed to UV light, but otherwise has low sensitivity to the environment.

c. Carbon Fiber Reinforced Plastic (CFRP) has low sensitivity to the environment.

Susceptibility to delamination and disbonding is assessed on the basis of material type, adequacy of the protective system, and structural composition (e.g., honeycomb and solid laminate), coupled with the likelihood of AD, and exposure to certain environmental conditions.

4. Rating Fatigue Damage

~~The rating system must lead to inspections that provides a high probability of detecting fatigue damage in the fleet before such damage reduces any aircraft's residual strength below allowable levels. To achieve this, the rating system should consider the following~~:

~~a. Residual strength, including the effects of multiple site fatigue damage, where appropriate.~~

~~b. Crack growth rate, including effects of multiple site or multiple element fatigue damage, where appropriate.~~

~~c. Damage detection period which corresponds to the interval for the fatigue damage to grow from the threshold of detection (detectable) to the limiting size defined by "a" (critical). This period will vary according to the inspection method used, and may be influenced by structural parts or processes, e.g., sealant obscuring parts of the damage.~~

~~d. Detection standards for applicable inspection methods.~~

~~NOTE: Estimated detectable crack lengths can be used for the fatigue damage detection evaluations required as part of aircraft type certification.~~

~~e. Applicable inspection levels and methods (e.g., visual, NDI), directions (e.g., external, internal) and repeat intervals (e.g., C, 2C, 4C).~~

If a rating system to determine the detectability of the fatigue damage and feasibility of the inspection is used, it should consider the different inspection levels and methods, accessibility conditions, expected inspection conditions (e.g. sealant obscuring the damage location).

NOTE: Estimated detectable crack lengths can be used for the fatigue damage detection evaluations required as part of aircraft type certification.

Deleted: The rating system must lead to inspections that provides a high probability of detecting fatigue damage in the fleet before such damage reduces any aircraft's residual strength below allowable levels. To achieve this, the rating system should consider the following:¶
a. . Residual strength, including the effects of multiple site fatigue damage, where appropriate.¶
b. . Crack growth rate, including effects of multiple site or multiple element fatigue damage, where appropriate.¶
c. . Damage detection period which corresponds to the interval for the fatigue damage to grow from the threshold of detection (detectable) to the limiting size defined by "a" (critical). This period will vary according to the inspection method used, and may be influenced by structural parts or processes, e.g., sealant obscuring parts of the damage.¶
d. . Detection standards for applicable inspection methods.¶
NOTE: . Estimated detectable crack lengths can be used for the fatigue damage detection evaluations required as part of aircraft type certification.¶
e. . Applicable inspection levels and methods (e.g., visual, NDI), directions (e.g., external, internal) and repeat intervals (e.g., C, 2C, 4C).¶

