

International Maintenance Review Board Policy Board (IMRBPB)

Issue Paper (IP)

Initial Date (DD/MMM/YYYY):07DEC2011

IP Number: CIP EASA 2011-3

Revision / Date (DD/MMM/YYYY):Rev 0 / 07/dec/2011

Title: Adaptation of the Fatigue Damage Analysis Logic

Submitter: EASA MRB Section

Issue: The FD analysis logic in MSG3 should be updated to better clarify the intent of the MSG3 FD analysis carried out within the MRB process, especially with regard to the distinction of FD analysis performed for PSE within the certification process and the FD assessment of non-PSE SSI as part of the scheduled maintenance requirements development.

In addition, the zonal transfer of structural maintenance requirements should be reflected clearer within the structural analysis logic.

Problem: Within section 2-4-4 and the related logic diagram 2-4-4.1 of the current version of the MSG3 document, the development of the scheduled structural maintenance requires FD analysis for all SSI of the aircraft structures, including PSE and non-PSE.

Subsequent to the FD analysis that is described with logic diagram 2-4-4.6, the PSE are distinguished from non-PSE and the related requirements for the PSE are transferred to the AWL document that is controlled by the certification process.

In parallel, the FD assessment of structural PSE is required also within the certification process of the relevant aircraft type.

Hence, within the MRB process, MSG3 requires conducting FD analysis for PSE and non-PSE, although the FD analysis for PSE is covered already by the type certification process of the aircraft.

In addition, MSG3 provides the opportunity to assess structural maintenance requirements that fulfil specific characteristics to be proposed as candidates for zonal transfer. This process is not clearly reflected within the structural maintenance requirements logic diagrams.

Recommendation (including Implementation): It is recommended to revise the logics 2-4-4.1 and 2-4-4.6 as per the proposal attached, in order to:

- Clarify the FD analysis within the MRB process by segregation of PSE from non-PSE as a step prior to the accomplishment of FD analysis itself and to prevent duplication of FD analysis for PSE in both MRB- and certification-process.
- Reflect better the possibility of zonal transfer of structural maintenance requirements, as described within the MSG3 document.

The proposed revisions of the above mentioned diagrams will also lead to some slight adaptations of the logic diagrams 2-4-4.2, 2-4-4.3 and 2-4-4.4, as well as the revision of wording in section 2-4-4 paragraph 1, a-y.

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Logic diagrams 2-4-4.2, 2-4-4.3 and 2-4-4.4:

Revise diagrams by replacing “TO P20” with “TO D9” at the bottom of the diagrams.

Wording in section 2-4-4 paragraph 1, a-y:

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 and are additionally subjected to AD/ED/CPCP analysis (either as metallic or non-metallic structure). They are to be categorized as PSE and non-PSE (D5a) ~~safe-life or damage-tolerant (D5), and are additionally subjected to AD/ED/CPCP analysis (either as metallic or non-metallic structure)~~. The SSI being non-PSE will be further assessed by FD/DT analysis ([Figure 2-4-4.6]). PSE will follow further analysis covered by the certification process and requirements (P15).

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 ~~evaluated for zonal transfer (D9) for~~ and will either become zonal inspection candidate (P20b) or will be included in the scheduled structural maintenance (P20a) (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. Task 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).

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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. Task 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 **evaluated for zonal transfer (D9) and will either become zonal inspection candidate (P20b) or will be included in the structural maintenance(P20a)-(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 (P16) and the manufacturer determines if timely detection of fatigue damage is dependent on scheduled inspections (P21)-(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).

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

t. Improved task requirement (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 (D8/P17). If this is not feasible for the manufacturer, the SSI must be categorized as safe life (P17).

*u. Fatigue related task requirements are **evaluated for zonal transfer (D9) and will either become zonal inspection candidate (P20b) or will be included in the scheduled structural maintenance (P20a) listed (P18).***

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

*v. ~~w~~ Tasks from AD, ED, FD (other than Airworthiness Limitations), and other structure analyses are **evaluated for zonal transfer (D9) and will either become zonal inspection candidate (P20b) or will be included in the scheduled structural maintenance (P20a) listed in the Scheduled Structural Maintenance (P20).***

*w. ~~x~~ The resulting maintenance requirements for all structure from step ~~“w”~~ **“v”** are submitted to the ISC for approval and inclusion in the MRB report proposal.*

x. ~~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.

IMRBPB Position:

Date:

Position:

Status of Issue Paper (when closed state the closure date):

Recommendation for implementation:

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Important Note: The IMRBPB positions are not policy. Positions become policy only when the policy is issued formally by the appropriate National Aviation Authority.