

**International Maintenance Review Board Policy Board (IMRBPB)
Issue Paper (IP)**

Initial Date (19/11/2007):

IP Number: 92

Revision / Date: Rev.2 /02 APR 2009

Title: Definition of Structural Health Monitoring (SHM)/Addition to MSG-3.

Submitter: Joint Industry Proposal (Airbus, Boeing, Bombardier, Embraer, Fuji Heavy Industries)

Issue: The current MSG-3 document does not have a definition of Structural Health Monitoring (SHM) technology.

Problem: Currently, SHM is not recognized in MSG-3 document as a viable detection technique/method.

Recommendation (including Implementation):

1) ATA MSG-3 SHM Working Group recommends below SHM definition to be placed in ATA MSG-3, 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.

Comment [LW1]: "Checking or watching" could possibly be improved (may be use "observed" or "assessing")

[...]

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.

[...]

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2) ATA MSG-3 SHM Working Group recommends to amend the ATA MSG-3 document as follows:

Reword and extend chapter 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/Service (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)

[...]

Insert new paragraph to chapter 2-4-2:

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.

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Extend chapter 2-4-4:

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.

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Reword and extend the procedure described in chapter 2-4-4.1:

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.

[...]

- 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).**

[...]

- 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 included in the structural maintenance (P20).

[...]

- | |
|---|
| UNDER REVISION BY IP103 (thus S-SHM changes not addressed) |
| 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. The manufacturer may propose validated S-SHM application(s) to provide necessary fatigue damage detection opportunities if applicable and effective.~~

~~uv. Details of the fatigue related 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 (D9). Improved task access and/or redesign of the SSI may be required if no practical and effective visual and/or nondestructive inspections are available (D10, P19) **and S-SHM is not an applicable and effective alternative. If this none of the options are is not** feasible for the manufacturer, the SSI must be categorized as safe-life (P17).~~

~~vw. Fatigue related task requirements are listed.~~

[...]

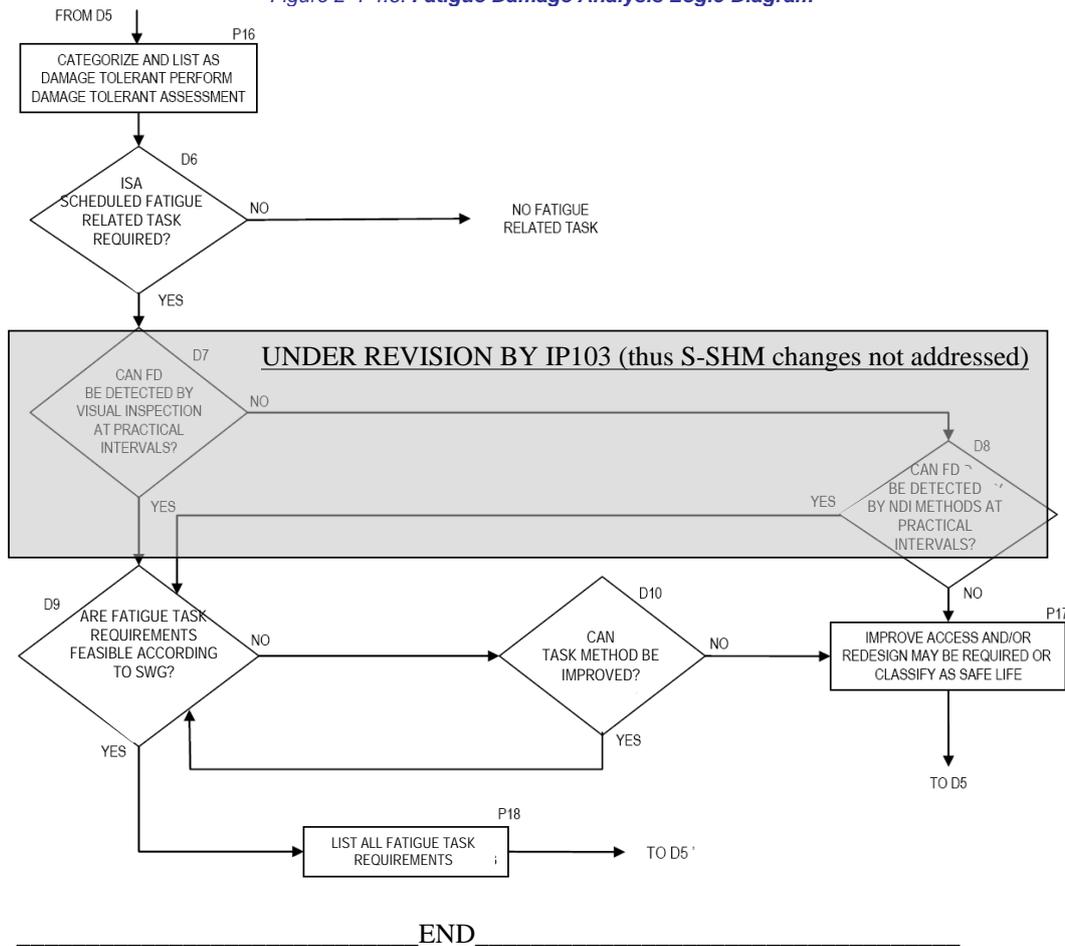
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Figure 2-4-4.6. Fatigue Damage Analysis Logic Diagram



END

IMRBPB Position:

Date: 03/04/2009

Position: Proposal called "IP92and103combined final version" in attachment agreed

Status of Issue Paper (when closed state the closure date): Closed on April the 3rd, 2009.

Recommendation for implementation:

Proposed changes as per "IP92and103combined final version" to be implemented in MSG 3 revision 2009.

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