1) ATA MSG-3 SHM Working Group recommends below SHM definition to be placed in ATA MSG-3, Appendix A, Glossary section as follows:

Chapter 2. Development of Scheduled Maintenance

…

2-1. General

…

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)

and

b) A group of non-scheduled tasks which result from:

(1) The scheduled tasks accomplished at specified intervals.

(2) Reports of malfunctions (usually originated by the operating crew).

(3) Data analysis.

(4) Reports of potential failures (e.g. originated by the aircraft monitoring).

…

2-3-1. MSI Selection

…

1. Step 1.

NOTE:	Items within the Structural ATA Chapters (51-57) that lend themselves to System analysis (e.g., flight control hinge bearings, fuselage drains, door hinge and mechanisms, etc.) and SHM systems should be included in this step and coordinated with the Structures Working Group in accordance with established transfer policy and procedures. In addition, all safety/emergency systems or equipment should also be included.

…

4. Step 4

NOTE:	SHM systems not selected as MSI and their correspondent lower-level items list shall be provided to the Structures Working Group for awareness in accordance with established transfer policy and procedures prior to ISC final review and approval.

….

6. Step 6

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. Additionally, if MSI covers SHM systems, the results of the analysis shall be provided to the Structures Working Group.

Comment [LW1]: there may be a better place to put this note. Find a place where the MSI result is going to be ready for the SWG. Need to harmonise with IP96

…

2-3-5. Consequences of Failure (First Level)

…

3. Hidden Functional Failure Safety Effect

QUESTION 3:	**DOES THE COMBINATION OF A HIDDEN FUNCTIONAL FAILURE AND ONE ADDITIONAL FAILURE OF A SYSTEM RELATED OR BACK-UP FUNCTION HAVE AN ADVERSE EFFECT ON OPERATING SAFETY?**

This question is asked of each hidden functional failure which has been identified in Question 1.

The question takes into account failures in which the loss of the one hidden function (whose failure is unknown to the operating crew) does not of itself affect safety; however, in combination with an additional functional failure (system related or intended to serve as a back-up) has an adverse effect on operating safety.

For hidden functions of safety/emergency systems or equipment (see Glossary), the additional failure is the event for which this function of the system or equipment is designed, and in these cases, where the system has no redundancies, a FEC 8 is to be selected. In the event that structural a damage monitoring system is identified as a safety/emergency systems or equipment (see Glossary), the secondary event is the failure of structure monitored. For redundant systems, if the system failure remains hidden after the failure of the first redundancy, a FEC 8 is also to be selected. This applies irrespective of whether the function is required by regulation or is carried as an operator option.

If a "YES" answer is determined, there is a safety effect and task development must proceed in accordance with [Heading 2-3-6.4].

A "NO" answer indicates that there is a non-safety effect and will be handled in accordance with [Heading 2-3-6.5].

…

2-3-7. Task Development (Second Level)

…

3. Inspection/Functional Check (All Categories)

QUESTION 5B, 6B, 7B, 8C & 9C.	IS AN INSPECTION OR FUNCTIONAL CHECK TO DETECT DEGRADATION OF FUNCTION APPLICABLE AND EFFECTIVE?

An inspection is:

A. GENERAL VISUAL INSPECTION (GVI)

A visual examination of an interior or exterior area, installation or assembly to detect obvious damage, failure or irregularity. This level of inspection is made from within touching distance, unless otherwise specified. A mirror may be necessary to enhance visual access to all exposed surfaces in the inspection area. This level of inspection is made under normally available lighting conditions such as daylight, hangar lighting, flashlight or drop-light and may require removal or opening of access panels or doors. Stands, ladders or platforms may be required to gain proximity to the area being checked.

OR

B. DETAILED INSPECTION (DET)

An intensive examination of a specific item, installation or assembly to detect damage, failure or irregularity. Available lighting is normally supplemented with a direct source of good lighting at an intensity deemed appropriate. Inspection aids such as mirrors, magnifying lenses, etc. may be necessary. Surface cleaning and elaborate access procedures may be required.

OR

C. SPECIAL DETAILED INSPECTION (SDI)

An intensive examination of a specific item, installation, or assembly to detect damage, failure or irregularity. The examination is likely to make extensive use of specialized Inspection Techniques and/or equipment. Intricate cleaning and substantial access or disassembly procedure may be required.

NOTE:	A GVI identified through application of Systems/Powerplant logic may not subsequently be considered as covered by a zonal inspection as described in paragraph 2-5-1(h) if it is derived from either a Category 5 or 8 analysis. At the level of the originating document, such a task must be retained as a standalone GVI task within the MSI from which it was identified.

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

Comment [LW2]: The scope could be extended to include global health monitoring. Propose to delete.

A functional check is a quantitative check to determine if one or more functions of an item performs within specified limits.

…

2-4. Aircraft Structural Analysis Procedure

…

2-4-2. Scheduled Structural Maintenance

…

9. Structural Monitoring Systems

Structural Health Monitoring systems that are certified for their intended function may be used to ensure inherent airworthiness of the item being monitored. The specific design of this monitoring system will determine the approach that should be used with regards to scheduled maintenance requirements. The corresponding procedures need to be developed and approved/accepted at the level of the PPH. SHM systems are classified by operation mode AND technology type. These classifications will determine what procedures are used. Operation mode classifies how the SHM system interacts with maintenance personnel, while technology type describes what sort of conditions the system measures.…

2-4-4. Scheduled Structural Maintenance Development

…

1. Procedure

…

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 including damage detected and reported by a SHM system (D6).

…

2-4-6. Evaluation of Structural Health Monitoring Systems

When an automated structural health monitoring system is used to monitor structure which has maintenance/inspection requirements, appropriate transfer policies should be used to show that the intent of the damage detection (ED/AD/FD) requirement is being satisfied by the monitoring system. This process takes place after the development of the Structures Requirements described previously in this section (see appendix glossary for details).

1. Damage Monitoring Systems

For Damage monitoring systems (i.e. installed sensors which detect deterioration conditions on structure):

a. SHM system capabilities/specification are presented to the SWG (D9/ P21/D10). This information may include technical description of the system, SHM damage detection capabilities for ED/AD/FD, SHM system monitoring capabilities (inspection rate; i.e. every hour, year, etc.), and inherent reliability of the system (including the MSI systems analysis result).

b. Structures working group determines whether the SHM system capabilities meet or exceed the detection requirements derived from Structures MSG-3 (D11).

c. If the entire MSG-3 detection requirement is met, the item is listed as “Inspection Requirements affected by monitoring system” (P22). No task is then listed in the MRBR report/task list (P23).

d. In some cases the inspection requirement may be augmented if the full detection requirement is not met by the SHM system (D12). For these task(s) it must be indicated that they are modified/affected by a monitoring system (P24).

e. If no part of the detection requirement is met (D12), then the ED/AD/FD detection requirement must be addressed by a scheduled maintenance task in the MRBR/task list (P25) or a redesign of the SHM system may be considered (P26/D13).

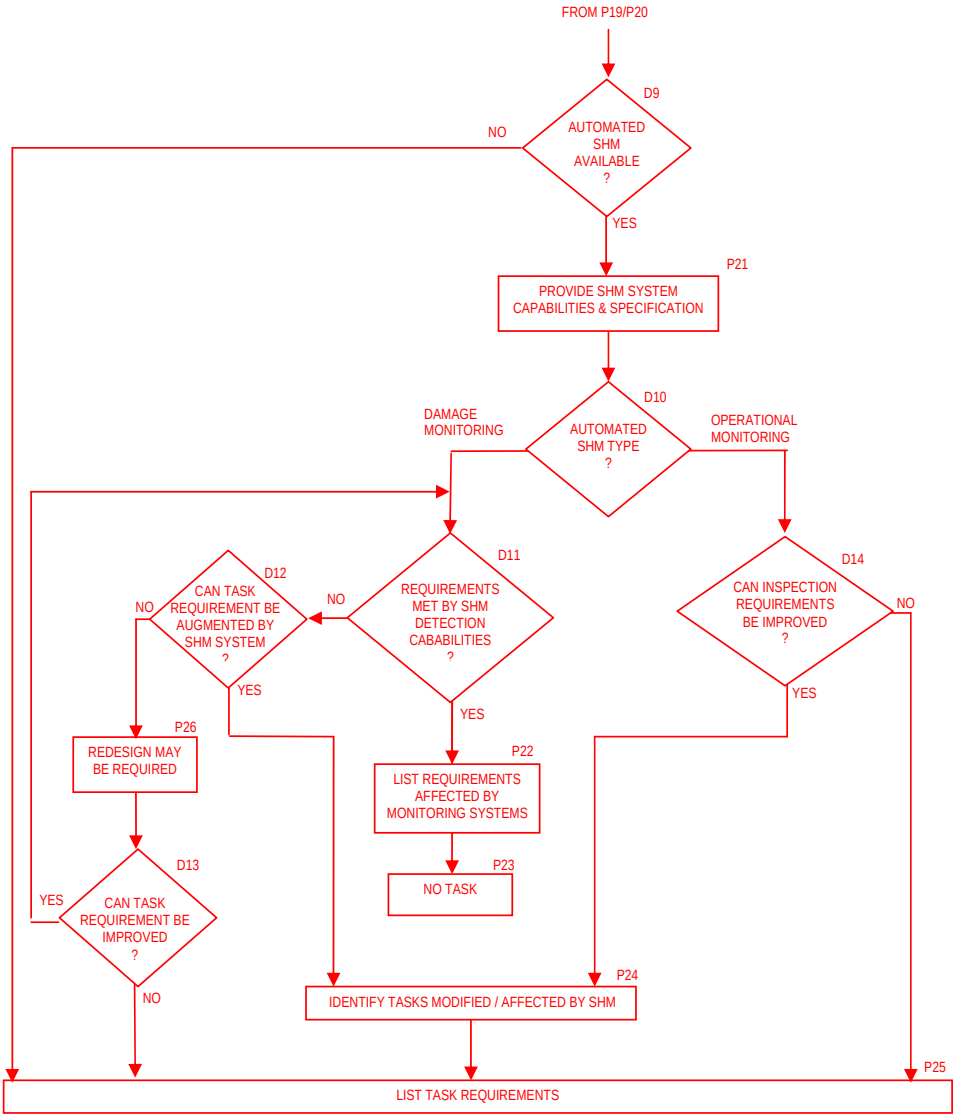
2. Operational Monitoring Systems

For operational monitoring systems (i.e. load monitoring or environmental condition monitoring):

a. SHM system capabilities/specification are presented to the SWG (D9/ P21/D10). This information may include technical description of the system, SHM operational monitoring capabilities (data availability and storage, sensor type/quantity, data collection rate), and inherent reliability of the system (including the MSI systems analysis result).

b. The SWG determines the effect of the SHM system capabilities to improve the derived structures inspection requirements (e.g. task interval, inspection boundaries, inspection level) (D14). The revised inspection requirement will be listed in the MRBR/task list (P25). For these task(s) it must be indicated that they are modified/affected by a monitoring system (P24).

Figure 2-4-5.1. ***Evaluation of Structural Health Monitoring Systems Logic Diagram***



…

Appendix A. Glossary

…

Automated SHM	Automated SHM is any SHM technology which does not have a pre-determined interval at which structure maintenance action must takes place, but instead relies on the system to inform maintenance personnel that action must take place (this only applies to structural maintenance items).

…

SHM System Operation Mode	The operation mode is classified as either "scheduled" or "automated". A system that must be interrogated by maintenance personnel in order to function is classified as "scheduled". A system that automatically initiates maintenance action is classified as "automated".

…

SHM Technology Type	The technology type is classified as either "Damage Monitoring" or "Condition Monitoring". Technology which uses installed sensors to directly detect deterioration conditions in the installed area are considered "Damage Monitoring" technology. SHM technology that uses sensors which do not directly check the structure for damage, but instead correlate various measurements (e.g. environment conditions, loads) to make an inference to the probability or likelihood of damage is considered condition monitoring.

…

Structural Damage Monitoring System	SHM technology that uses sensors to directly monitor structure for deterioration conditions.

…

Structural Operation Monitoring System	SHM technology that uses sensors which do not directly check the structure for damage, but instead correlate various measurements (e.g. environment conditions, loads) to make an inference to the probability or likelihood of damage.

END