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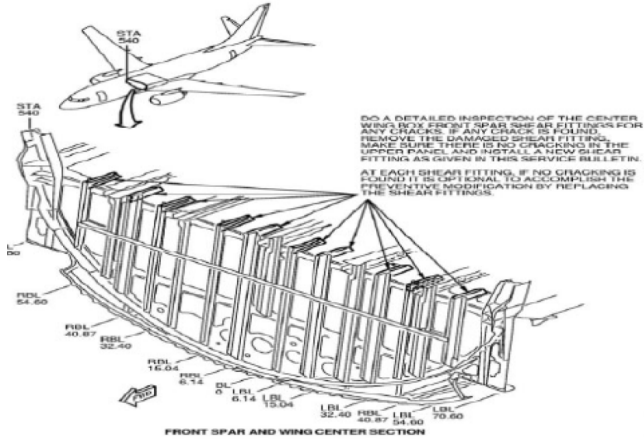
AMOC/AD with applied SHM

David Piotrowski
Delta TechOps
Chair – AISC-SHM
Vice-Chair – IVHM SG
MPIG Member

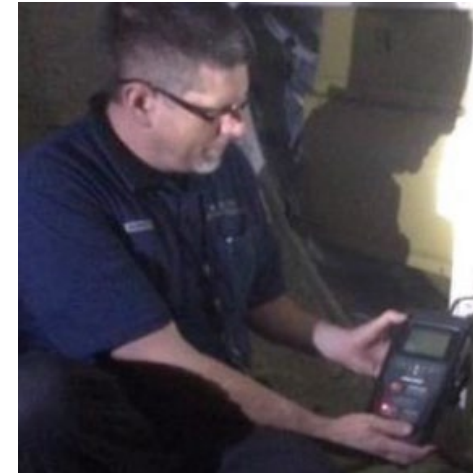
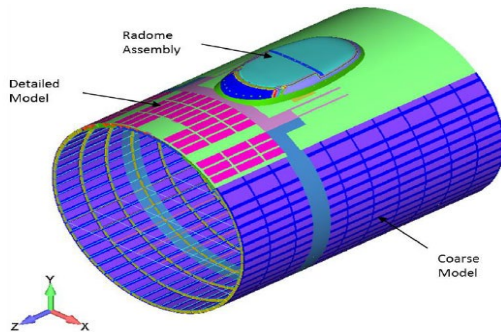
May 12, 2023

SHM Approved Applications

- Economic
 - B737 Wing, Shear Fittings (Boeing SB 737-57-1309 revised; B737 NDT Manual)

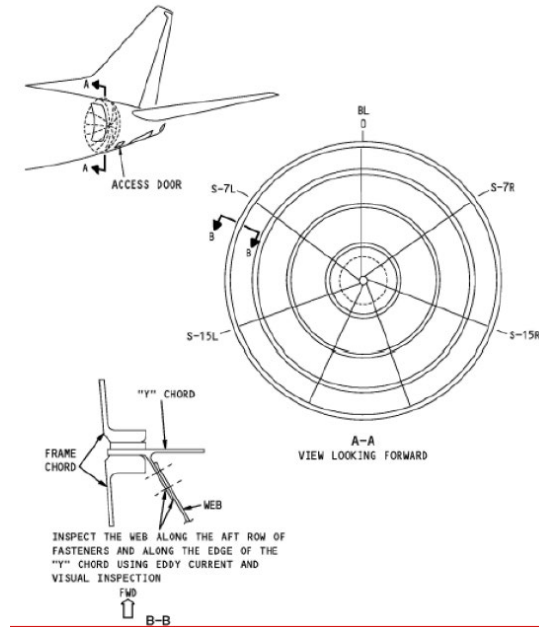


- STC ST04103NY
 - Wifi Antenna Structure ICAs



SHM Application – AMOC Imminent

- AD 2016-18-15
 - B737 APB Y-Chord (B737-53A1248)
 - 1200 cycle repetitive inspection
 - AMOC Approval expected Q3 2023



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FAA's SHM Issue Paper

FAA POSITION:

The applicant must demonstrate that their inspections or other procedures, including the use of the proposed SHM system to detect damage, complies with the requirements of §§ 25.571 and 25.1529. The applicant should fully describe their means of compliance with §§ 25.571 and 25.1529, including, but not limited to, the following:

- ❑ SHM system performance and damage detection capability.
- ❑ Reliability and durability considerations of SHM as a system, including how you will evaluate them.
- ❑ Applicability of the necessary tasks for continued airworthiness of the airplane.
- ❑ Applicability of compliance considerations and data development for certifying a SHM system.



ISSUE PAPER

PROJECT:	[Applicant] Model [make & model] Project No. [project number]	ITEM: A-#
REG. REF.:	14 CFR § 21.50, § 25.571, §25.1529, Appendix H	STAGE:
NATIONAL POLICY REF:	AC 25.571-1D	DATE:
SUBJECT:	Qualification of a Structural Health Monitoring System for Detection of Damage in Structure	ISSUE STATUS: Open
		OFFICE ACTION: AIR-621, AED
		COMPLIANCE TARGET:

Method of Compliance

STATEMENT OF ISSUE:

The applicant proposes to install a Structural Health Monitoring (SHM) system on a model <Enter TCDS Model(s)> airplane. An SHM system evaluates the integrity of structure by acquiring and analyzing data from on-board sensors that interface with an electronic device (either on-board or off-board) that processes the data and provides an indication of the health of structure in terms of the existence of damage (e.g., fatigue damage). A SHM technology capable of reliably detecting damage of a specific nature and size over a specific line, area or volume is a candidate alternative to conventional non-destructive inspections (NDI) such as visual, eddy current, ultrasonic and X-ray inspections methods. This approach for detecting structural damage may supplement or eliminate the need for an inspector to physically access and assess structure. Over the past 30 plus years, industry has relied on accessing structure to assess its overall integrity and, as part of that assessment, perform NDI such as visual and eddy current inspections, to detect structural damage. The current industry practice and guidance used to validate conventional NDI techniques may not be adequate as a method of compliance with title 14, Code of Federal Regulations (14 CFR) 25.571 and 25.1529 for an SHM system. Therefore, this issue paper is necessary to establish an acceptable method of compliance.

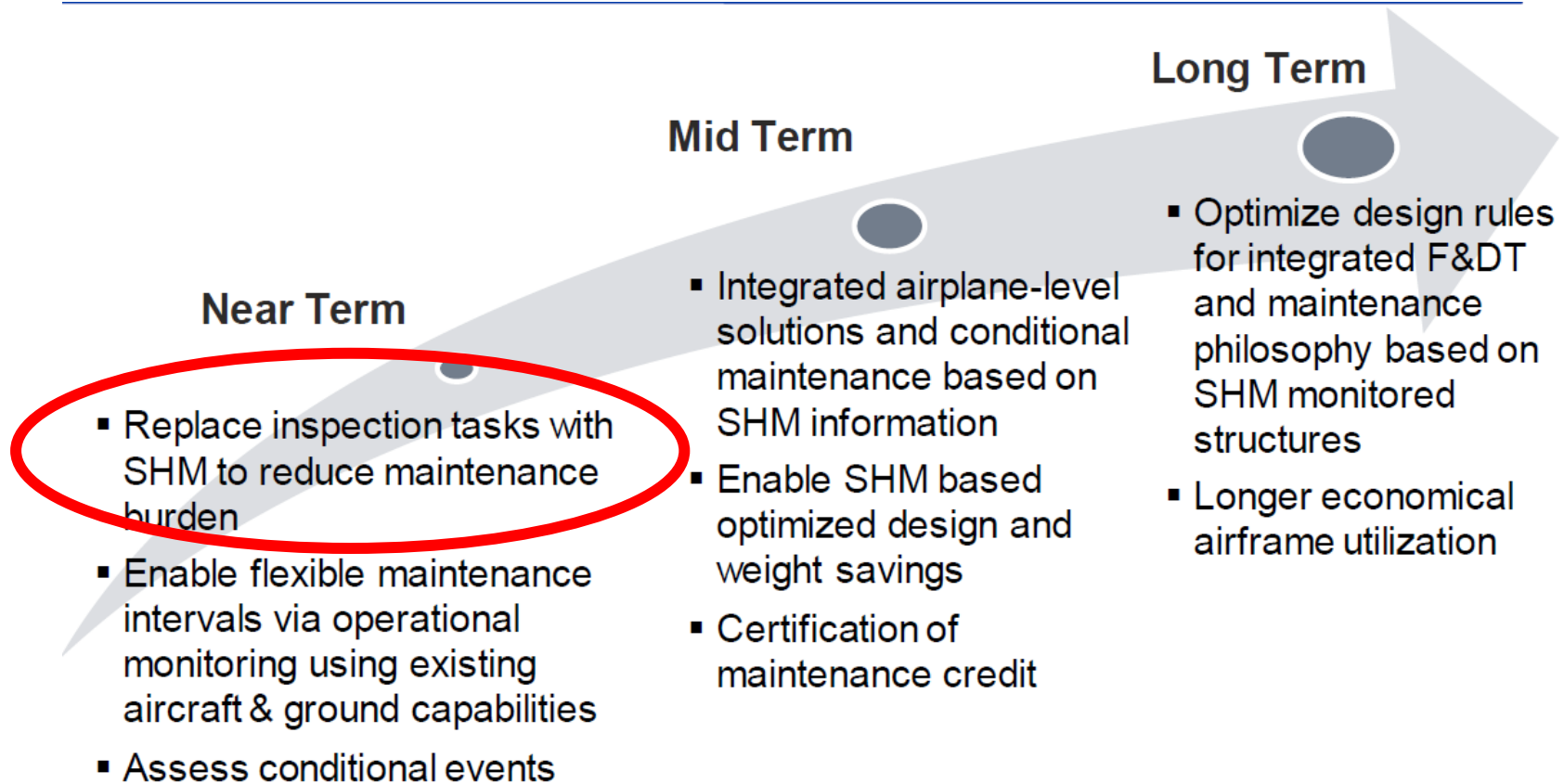


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SHM Variations – Only 1 of 3 has been used & approved

- Conventionally scheduled tasks making use of AHM/SHM equipment
 - Go to aircraft at fixed intervals (Scheduled SHM or S-SHM)
 - Use equipment to determine condition;
 - Act if necessary
 - Examples: Wifi STC, B737 APB AMOC, B737 Wing Center Section Fittings
- Conventional tasks scheduled by smart usage parameters (Operational)
 - Monitor usage of aircraft to determine time when action required
 - Perform conventional task (inspection, restore, discard) at that time
 - Examples: AMM Ch 5 Inspections; Impact sensors, Moisture sensors
- Continuous monitoring of the structure/system (Automated SHM or A-SHM)
 - Continuously collect, process and analyze data;
 - Act when required
 - Examples: Zonal alternative (large area sensing); 'Monitor known damage'

AISC-SHM View of Goals



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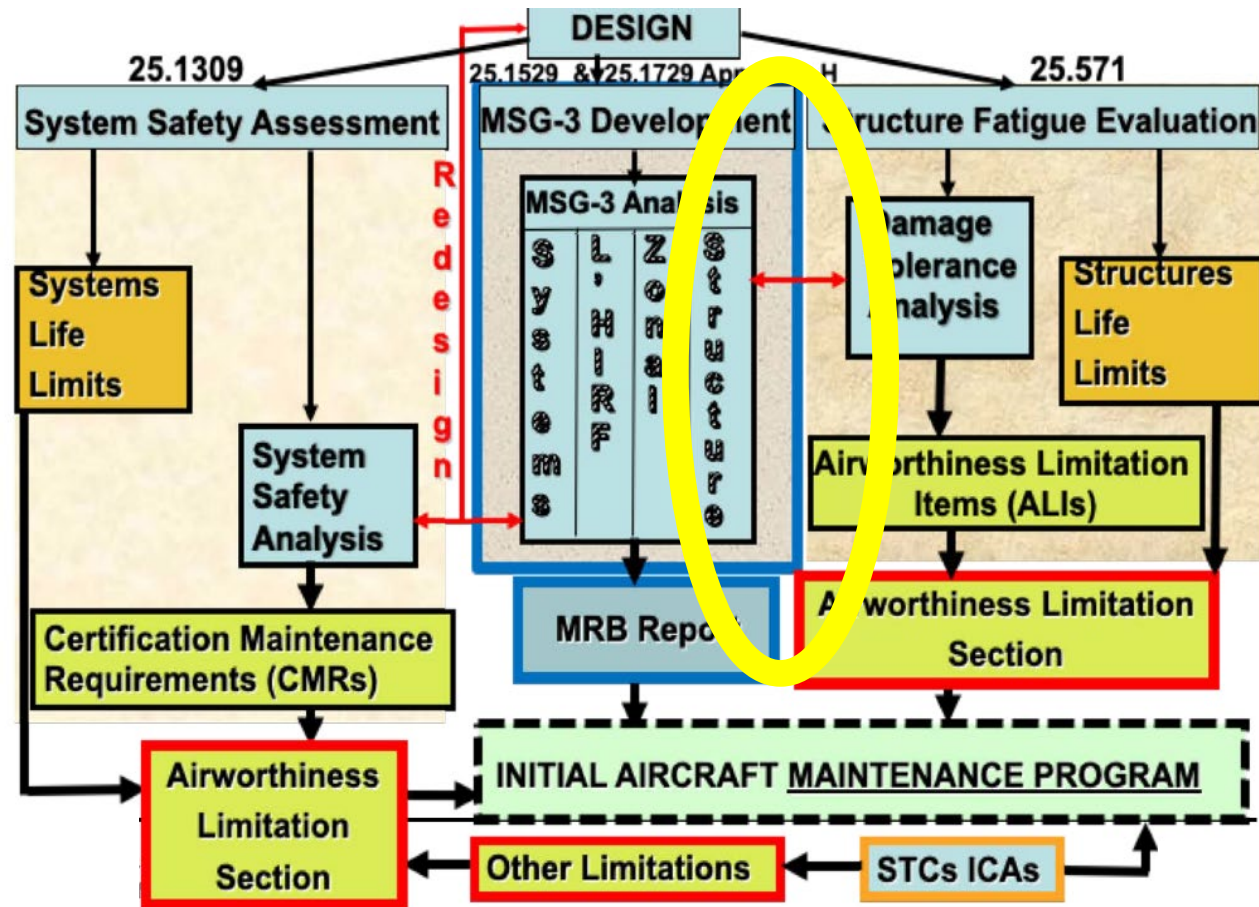
ALI, AD, STC vs MRBR

Initial work:

- OEMs working applications
 - Multiple technologies
- 'Hot spots'
- SB Revisions, NDT Manual
- ALIs or ADs
- S-SHM (same DT interval)

Future work:

- MSG-3 tasks
- Continuous 'monitoring'
- Large areas



MRBR Potential Use Cases



737-600/700/800/900/900ER MAINTENANCE REVIEW BOARD REPORT STRUCTURAL MAINTENANCE PROGRAM

MRB ITEM NUMBER	P G M	ZONE	ACCESS	INTERVAL		APPLICABILITY		TASK DESCRIPTION
				THRESHOLD	REPEAT	APL	ENG	
53-415-00	S	836 846	836 846 NOTE	36 MO 6600 FC NOTE	36 MO 6600 FC NOTE	900ER NOTE	ALL	<p><i>INTERNAL - DETAILED:</i> Mid Exit Structural Plug Surround Inspect mid exit structural plug surround stops and fittings.</p> <p><i>AIRPLANE NOTE:</i> Applicable to airplanes with mid exit structural plugs installed.</p> <p><i>INTERVAL NOTE:</i> Whichever comes first.</p> <p><i>ACCESS NOTE:</i> Inspect with plug open. Remove galleys/lavs and as required the cabin interior, linings and insulation.</p>
53-417-00	S	836 846	836 846 NOTE	36 MO 6600 FC NOTE	36 MO 6600 FC NOTE	900ER NOTE	ALL	<p><i>INTERNAL - DETAILED:</i> Mid Exit Structural Plug Inspect mid exit structural plug stop fittings and pins.</p> <p><i>AIRPLANE NOTE:</i> Applicable to airplanes with mid exit structural plugs installed.</p> <p><i>INTERVAL NOTE:</i> Whichever comes first.</p> <p><i>ACCESS NOTE:</i> Inspect with plug open. Remove galleys/lavs and as required the cabin interior, linings and insulation.</p>
53-418-00	S	836 846	836 846 NOTE	36 MO 6600 FC NOTE	36 MO 6600 FC NOTE	900ER NOTE	ALL	<p><i>EXTERNAL - GENERAL VISUAL:</i> Mid Exit Structural Plug Inspect mid exit structural plug skin and structure.</p> <p><i>AIRPLANE NOTE:</i> Applicable to airplanes with mid exit structural plugs installed.</p> <p><i>INTERVAL NOTE:</i> Whichever comes first.</p> <p><i>ACCESS NOTE:</i> Inspect with plug open. Remove galleys/lavs and as required the cabin interior, linings and insulation.</p>



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SHM & MPIG/IMRBPB History

- IP 92 => SHM terms were incorporated in MSG-3 but how to apply it was omitted.
 - Everywhere 'NDT', replaced with 'NDT/SHM'
- IP 105 => Automated SHM (A-SHM) proposed; not adopted
 - No guidance, application ex in '10
 - Today, guidance exists (SAE)
- Current regulation is 'task-based':
 - ICAs followed, Work signed-off, Aircraft RTS

Summary of the CIP content

The CIP does NOT eliminate the existing baseline inspections scheme for structure, but is complimentary to it

There will always be a "classic" inspection task developed for all SSI (hence SHM is an alternative to the inspection)

Detailed policy will need to be further defined in accordance with the specific SHM technology application at PPH level

Any SHM used in the MRBR scope will need to get acceptance at ISC / PPH level for the policy and SWG / MRB level for the technical relevance and results

EASA 2022:

- We need to add a 'process-based' approach to the maintenance regulations
 - We need to find a replacement of the dedicated release to service certificate by means to document continued a/w through monitoring processes
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Thank you for your time!

Contact: David.Piotrowski@delta.com