Issue Paper (IP)

IP Number: CIP IND 2020-09 (V1)
Initial Date (DD/MMM/YYYY): 12/NOV/2020
Revision / Date (DD/MMM/YYYY):
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Retroactivity (Y/N): N

		Applies To:	
Title:	Amendment to IP180 for clarifications regarding the examples of Level-3 Analysis (see IP 180 Rev 0, Appendix 2)	MSG-3 Vol 1	X
		MSG-3 Vol 2	
Submitter:	Industry (MPIG based on AHM WG proposal)	IMPS	

Issue:

Issue Paper 180, titled "Aircraft Health Monitoring (AHM) integration into MSG-3" proposes a systematic approach to integrate AHM capability within the MSG-3 process by introducing new language and new level of Analysis (Level-3 Analysis/ AHM Candidate Analysis). The IP includes, in its Appendix 2, a series of examples intended to present several scenarios of applying the MSG-3 Logic Diagram – Level 3 Analysis (see Fig 2-3-9.1 of the IP).

Problem:

With several industry entities (OEMs and Airlines) engaged in following the IMRBPB recommendation for implementation as concluded in the IP 180, several questions emerged regarding the examples in Appendix 2. Answering these questions highlighted the need of improving the clarity of the example set and its consistent alignment with the MSG-3 new wording endorsed by the IP 180.

While the Appendix 2 is not intended for inclusion in the MSG-3 document revision, it is considered to be of significant support to users of the AHM approach as predicated by IP 180 at this stage and prior to actual inclusion of Level-3 Analysis in the MSG-3.

Consequently, this CIP proposes the amendment of Appendix 2 of IP 180 as detailed below.

Recommendation (including Implementation):

Replace the existing content of Appendix 2 of the IP 180 Rev 0, which comprises a set of seven examples, with the following set of four examples:

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Selection of AHM Hybrid - example: AHM Candidate "Change oil" with Level 3 Analysis path 2-3-9.1/2-3-9.B/2-3-9.C

MRBR TODAY

MRBR Task Ref.	Task Code	Task Description	FEC	Task Threshold	Task Interval	Task Applicability
24-0x0-00	SVC	Change oil	6	N/A	1500 FH	ALL

MRBR FUTURE CONTENT

MRBR Task Ref.	Task Code	Task Description	FEC	Task Threshold	Task Interval	Task Applicability
24-0x0-00	SVC	Change oil NOTE: there is AHM capability available to comply with this task – see AHM 24-0x0-01	6	N/A	1500 FH	ALL
24-0x0-01	SVC	Change oil NOTE: this task is approved in conjunction with AHM 24-0x0-01	6	N/A	3000 FH	ALL

AHM Selection Ref.	AHM Selection Type	AHM Selection Description	Associated Task Ref (only for AHM Hybrid)	AHM Selection Applicability

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	AHM 24-0x0-01	AHM Hybrid	Alert for oil quantity NOTE: the AHM 24-0x0-01 in conjunction with MRBR Task 24-0x0-01 is approved as alternative means of compliance with MRBR Task 24-0x0-00	24-0x0-01	ALL

SYSTEM INFO

Oil sump volume between full and the bottom of the "normal" range is 1500 cc.
The input shaft seal leakage is designed to control oil leakage to a maximum of 1 cc per flight hour in normal operation.
The oil sump volume is sized to provide a minimum of 1500 FH in the "normal" range assuming the maximum allowable leakage rate.
Suggested 3000 FH interval for oil and filter replacement.

AHMS INFO

Oil level / sump volume available for monitoring each flight.
Actual leakage rate instead of assumed leakage rate can be used for task scheduling.
Leakage rate monitoring does not address oil quality or filter clogging. Thus, the 3000 FH threshold of the oil change task.

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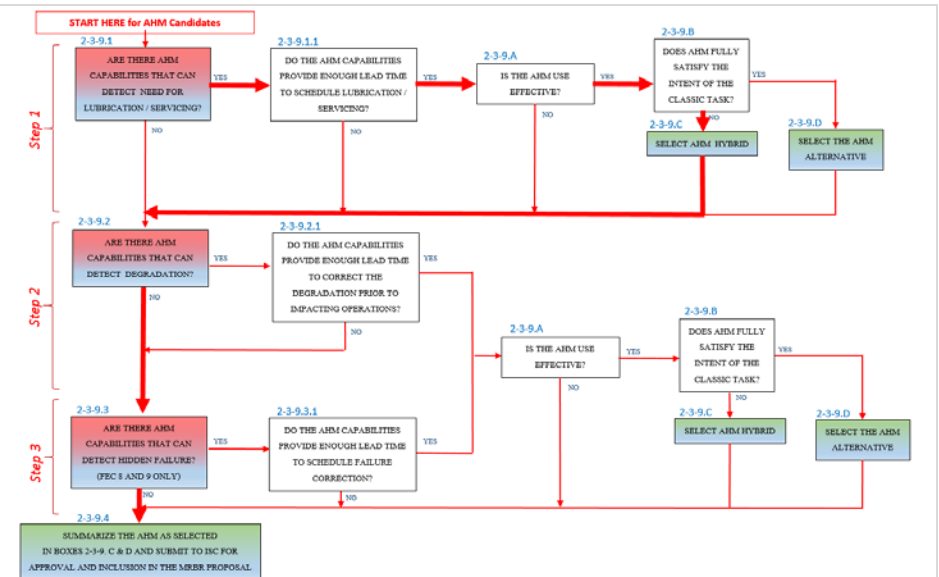
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Functional Failure	FEC 6	Fails to provide electric power from a single VFSG
Associated Failure Cause and Task	Failure Cause:	VFSG Fails
	Resulting task:	Change VFSG Oil @ 1500FH
AHM Candidate		
2-3-9.1 ARE THERE AHM CAPABILITIES THAT CAN DETECT NEED FOR LUBRICATION / SERVICING?	YES	Oil level / sump volume is available for monitoring each flight.
2-3-9.1.1 DO THE AHM CAPABILITIES PROVIDE ENOUGH LEAD TIME TO SCHEDULE LUBRICATION / SERVICING?	YES	Rate of oil loss can be monitored to determine optimum time to service prior to reaching functional failure.
2-3-9.A IS THE AHM USE EFFECTIVE?	YES	Utilizing AHM will prevent functional failure from occurring.
2-3-9.B DOES AHM FULLY SATISFY THE INTENT OF THE CLASSIC TASK?	NO	While AHM detects level of oil and will notify the operator once oil levels are getting low. It does not detect oil quality which can also lead to functional failure.
2-3-9.C SELECT AHM HYBRID		Same as Classic Task with a different interval. New MRBR Task: 24-0x0-01 Change Oil (AHM) Interval: AHM-determined, not to exceed 3000FH
2-3-9.2 ARE THERE AHM CAPABILITIES THAT CAN DETECT DEGRADATION	NO	AHM does not detect degradation of oil quality
2-3-9.3 ARE THERE AHM CAPABILITIES THAT CAN DETECT HIDDEN FAILURE (FEC 8 & 9 ONLY)	N/A	FEC 6
2-3-9.4 SUMMARIZE THE AHM AS SELECTED IN BOXES 2-3-9. C & D AND SUBMIT TO ISC FOR APPROVAL AND INCLUSION IN THE MRBR PROPOSAL		New MRBR Task 24-0x0-01 applicable only to operators utilizing an AHM program at an AHM-defined interval not to exceed 3000FH. Classic Task 24-0x0-00 updated with applicability note to state alternative task via usage of AHM available.
SUMMARIZE THE IMPACT AND SUBMIT TO ISC FOR APPROVAL AND INCLUSION IN THE MRBR		
AHM requirement/procedure		1) Monitor oil levels provided by parameter abc-123 2) Plot oil loss and determine when oil level will fall 1500cc below maximum level 3) Schedule oil servicing task (MRBR 24-0x0-01) prior to reaching that level 4) If it will take greater than 3000FH from last servicing task to reach 1500cc threshold, schedule task to be performed at or prior to to reaching 3000FH
MRBR classic task description updated --> to include traceability with approved AHM capability		MRBR 24-0x0-00 Change Oil AIRPLANE NOTE: Applicable to operators not utilizing MRBR task 24-0x0-01

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Selection of AHM Alternative – example: AHM Candidate "Brake wear check" with Level 3 Analysis path 2-3-9.2/2-3-9.B/2-3-9.D

MRBR TODAY

MRBR Task Ref.	Task Code	Task Description	FEC	Task Threshold	Task Interval	Task Applicability
32-170-00	VCK	Visually check for brake wear	9	N/A	100 FC	ALL

MRBR FUTURE CONTENT

MRBR Task Ref.	Task Code	Task Description	FEC	Task Threshold	Task Interval	Task Applicability
32-170-00	VCK	Visually check for brake wear NOTE: there is AHM capability available to comply with this task – see AHM 32-170-01	9	N/A	100 FC	ALL

AHM Selection Ref.	AHM Selection Type	AHM Selection Description	Associated Task Ref (only for AHM Hybrid)	AHM Selection Applicability
AHM 32-170-01	AHM Alternative	Alert for break wear limit (percent remaining) Note: the AHM 32-170-01 is approved as alternative means of compliance with MRBR Task 32-170-00	N/A	ALL

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SYSTEM INFO

The Electric Brake Actuator Controllers electronically determine brake-wear state based on motor-resolver output from each Electric Brake Actuator.
Brake wear data is displayed on the Landing Gear Brakes maintenance page for each brake position.

AHMS INFO

Break wear data (percent remaining) is available both on and off the aircraft via the Landing Gear Brakes maintenance page.
In addition, a Maintenance Message (MMSG) for the brake wear is available as a precursor to the eventual Flight Deck Effect (FDE).
Monitoring may be used to create actionable awareness of brake wear approaching limit as set in MMSG.
The above-mentioned capability could be used as an alternative to visual inspection.

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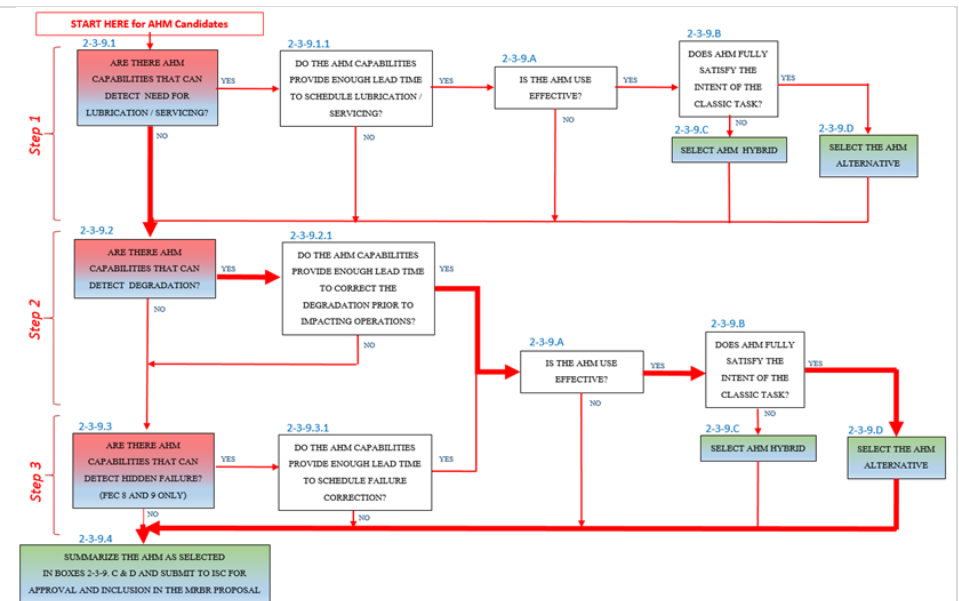
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Functional Failure	FEC 9	Fails to provide proper braking force in response to system
Associated Failure Cause and Task	Failure Cause:	Brake assembly worn beyond the limit of mechanical failure
	Resulting task:	Visually check for Brake wear
AHM Candidate		
2-3-9.1 ARE THERE AHM CAPABILITIES THAT CAN DETECT NEED FOR LUBRICATION / SERVICING?	NO	Lubrication/Servicing is not applicable for this failure cause because there is no consumable to replenish.
2-3-9.2 ARE THERE AHM CAPABILITIES THAT CAN DETECT DEGRADATION	YES	Brake wear data is available both on and off aircraft via Landing Gear Brakes maintenance page.
2-3-9.1.1 DO THE AHM CAPABILITIES PROVIDE ENOUGH LEAD TIME TO CORRECT THE DEGRADATION PRIOR TO IMPACTING OPERATIONS?	YES	Maintenance Messages can be created with customizeable limits based on operator preference. Once Brake Wear has reached the appropiate threshhold, corrective action to replace the brakes can be initiated.
2-3-9.A IS THE AHM USE EFFECTIVE?	YES	Utilizing AHM will alert the operator prior to functional failure.
2-3-9.B DOES AHM FULLY SATISFY THE INTENT OF THE CLASSIC TASK?	YES	The purpose of the classic task to monitor brake wear to determine functional degradation. The AHM also fulfills this intent..
2-3-9-D SELECT AHM AS ALTERNATIVE TO CLASSIC TASK		Classic task not applicable to operators using an AHM program. No alternative MRBR task created.
2-3-9.4 SUMMARIZE THE AHM AS SELECTED IN BOXES 2-3-9. C & D AND SUBMIT TO ISC FOR APPROVAL AND INCLUSION IN THE MRBR PROPOSAL		AHM fully precludes a scheduled maintenance task. Brake Wear can be monitored via the maintenance page or messages can be sent to the operator once certain limits have been reached.. Classic Task 32-170-00 updated with applicability note to state only applicable to operators not utilizing AHM
SUMMARIZE THE IMPACT AND SUBMIT TO ISC FOR APPROVAL AND INCLUSION IN THE MRBR		
AHM requirement/procedure		1a) Wait for maintenance message or 1b) Monitor brake wear via maintenance page 2) Schedule Brake replacement within set time frame.
MRBR classic task description updated --> to include traceability with approved AHM capability		MRBR 32-170-00 Visually check for Brake wear AIRPLANE NOTE: Applicable to operators not utilizing AHM Alternative 32-170-01. See Appendix X for more information

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Selection of AHM Alternative – example: AHM Candidate "Service Pressure Regulator Filter restauration/cleaning" with Level 3 Analysis path 2-3-9.2/2-3-9.A/2-3-9.B/2-3-9.D

MRBR TODAY

MRBR Task Ref.	Task Code	Task Description	FEC	Task Threshold	Task Interval	Task Applicability
21-51-00	RST	Restauration (cleaning) of Service Pressure Regulator Filter	9	N/A	750 FH	ALL

MRBR FUTURE CONTENT

MRBR Task Ref.	Task Code	Task Description	FEC	Task Threshold	Task Interval	Task Applicability
21-51-00	RST	Restauration (cleaning) of Service Pressure Regulator Filter NOTE: there is AHM capability available to comply with this task – see AHM 21-51-00	9	N/A	750 FH	ALL

AHM Selection Ref.	AHM Selection Type	AHM Selection Description	Associated Task Ref (only for AHM Hybrid)	AHM Selection Applicability

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	AHM 21-51-00	AHM Alternative	Service Pressure Regulator Filter differential pressure data readout and alert/action for filter cleaning Note: the AHM 21-51-00 is approved as alternative means of compliance with MRBR Task 21-51-00	N/A	ALL

SYSTEM INFO
One filter installed at the inlet of the service pressure regulator valve (Cooling Pack System). Air pressure regulator provides regulated and constant supply pressure to air valves. This air is filtered by the filter. Cleaning of the filter at 750 FH is applicable and effective to reduce pack failure rates.

AHMS INFO
Differential Pressure sensor installed between filter and SPR inlet will be used to capture pressure variations and it will be recorded by QAR. They should be downloaded and analyzed (measured value will be compared with a baseline curve) by ground station engineering.

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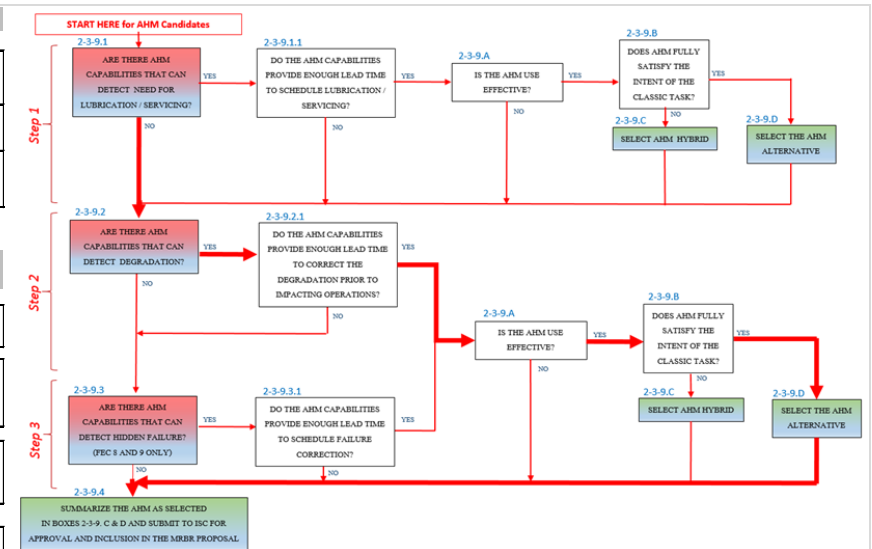*Revision / Date (DD/MMM/YYYY):*
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MSI 21-51 Cooling Pack		
FUNCTIONAL FAILURE	FEC 9	1.1 Main Pack System degraded performance (temperature control or ventilation rates).
ASSOCIATED FAILURE CAUSES AND CLASSIC LEVEL 2 TASK	Failure Cause:	1.1.1 Service Pressure Regulator (SPR) filter clogged.
	Resulting task:	MRBR ref: 21-51-00 at 750 FH RST: Restoration (Cleaning) of Service Pressure Regulator (SPR) filter

AHM Candidate - 1.1.1 Service Pressure Regulator (SPR) filter clogged.		
2-3-9.1 ARE THERE AHM CAPABILITIES THAT CAN DETECT NEED FOR LUBRICATION / SERVICING?	NO	There is no need of lubrication or service of Service Pressure Regulator (SPR) filter
2-3-9.2 ARE THERE AHM CAPABILITIES THAT CAN DETECT DEGRADATION?	YES	There is AHM capability to detect degradation by information of Differential Pressure Sensor. Pressure difference is used as an indicator for filter clogging.
2-3-9.2.1 DO THE AHM CAPABILITIES PROVIDE ENOUGH LEAD TIME TO CORRECT THE DEGRADATION PRIOR TO IMPACTING OPERATIONS?	YES	Measured values will be compared with baseline curve in order to show clogging level. Filter clogging can be detect XX hours before impacting operations.
2-3-9.A IS THE AHM USE EFFECTIVE?	YES	It is effective to assure the proper system operation avoiding filter clogging and reduction of unscheduled maintenance.
2-3-9.B DOES AHM FULLY SATISFY THE INTENT OF THE CLASSIC TASK?	YES	AHM procedure can detect degradation of the filter in order to replace the classic task.
2-3-9.D SELECT THE AHM ALTERNATIVE	-	AHM alternative task: AHM 21-51-00 is selected as alternative means of compliance for the classic task 21-51-00.
2-3-9.4 SUMMARIZE THE AHM AS SELECTED IN BOXES 2-3-9.C & D AND SUBMIT TO ISC FOR APPROVAL AND INCLUSION IN THE MRBR PROPOSAL		**AHM requirements / procedure** AHM Alternative - AHM 21-51-00 (approved as alternative means of compliance for Classic Task 21-51-00) Description: (SPR Filter) Differential pressure data readout; NOTE: Approved as alternative mean of compliance for Classic Task MRBR 21-51-00 Data collection and analyisis: to be executed per provisions in AHM 21-51-00 Procedure: GSE applicable/Personnel involved (Skill)/ Engineering Analysis/Maintenance Actions/Deviation information **MRBR Task Task 21-51-00** - description updated to include NOTE: there is AHM capability available to comply for this task - see AHM 21-51-00

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Selection of AHM Hybrid - example: AHM Candidate "Recirculation Air Filter discard" with Level 3 Analysis path 2-3-9.2/2-3-9.A/2-3-9.B/2-3-9.B and 2-3-9.2/2-3-9.3/2-3-9.4

MRBR TODAY

MRBR Task Ref.	Task Code	Task Description	FEC	Task Threshold	Task Interval	Task Applicability
21-24-01-00	DSC	Discard of Recirculation Air Filters	9	N/A	1000 FH	ALL

MRBR FUTURE CONTENT

MRBR Task Ref.	Task Code	Task Description	FEC	Task Threshold	Task Interval	Task Applicability
21-24-01-00	DSC	Discard of Recirculation Air Filters. NOTE: there is AHM capability available to comply with this task - see AHM 21-24-01	9	N/A	1000 FH	ALL
21-24-01-01	DSC	Discard of Recirculation Air Filters NOTE: this task is approved in conjunction with AHM 21-24-01	9	N/A	5000 FH	ALL

AHM Selection Ref.	AHM Selection Type	AHM Selection Description	Associated Task Ref (only for AHM Hybrid)	AHM Selection Applicability

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	AHM 21-24-01	AHM Hybrid	Recirculation Air Filter indication data readout and alert for discard of filter per task 21-24-01-01 NOTE: the AHM 21-24-01 in conjunction with MRBR Task 21-24-01-01 is approved as alternative means of compliance with MRBR Task 21-24-01-00	21-24-01-01	ALL

SYSTEM INFO

One filter installed at the inlet of each Recirculation Fan (Recirculation System).
Recirculation Fans provide recirculating air back into the distribution system, which is filtered by the filter.
Discard of the filter at 1000 FH is applicable and effective to reduce air contamination.

AHMS INFO

Differential Pressure sensor installed between filter and Recirculation Fan will be used to capture pressure variations, which will be recorded by QAR.
They should be downloaded and analyzed (measured value will be compared with a baseline curve) by ground station engineering.

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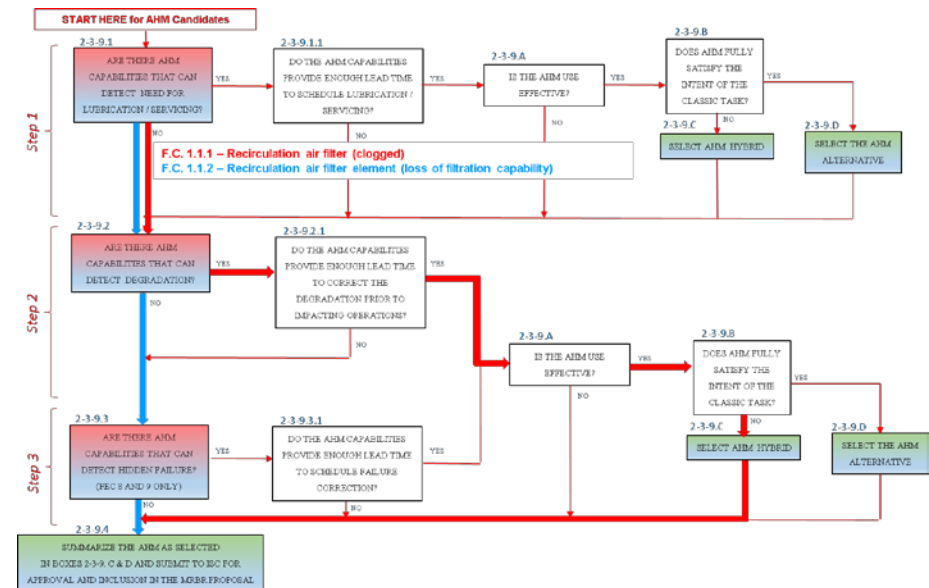*Initial Date (DD/MMM/YYYY): 12/NOV/2020*
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AHM Candidate 1.1.1 - Recirculation air filter failure (clogged)		
2-3-9.1 ARE THERE AHM CAPABILITIES THAT CAN DETECT NEED FOR LUBRICATION / SERVICING?	NO	There is no need of lubrication or service on Recirculation air filter
2-3-9.2 ARE THERE AHM CAPABILITIES THAT CAN DETECT DEGRADATION?	YES	The recirculation system is featured with a differential pressure sensor, which acquires parameter to be compared with an applicable standard in order to show clogging level.
2-3-9.2.1 DO THE AHM CAPABILITIES PROVIDE ENOUGH LEAD TIME TO CORRECT THE DEGRADATION PRIOR TO IMPACTING OPERATIONS?	YES	Recirculation air filter failure (clogged) can be detected XX hours before impacting operations.
2-3-9.A IS THE AHM USE EFFECTIVE?	YES	It is effective because the AHM maximizes the component usage time (remaining useful life) and reduces maintenance executions at each 1,000 FH with costs reduction.
2-3-9.B DOES AHM FULLY SATISFY THE INTENT OF THE CLASSIC TASK?	NO	AHM procedure can not detect all degradation modes of the Recirculation air filter element, not detecting the Failure Cause "Recirculation air filter element failure (loss of filtration capability)" in accordance with AHM candidate 1.2.1 analysis
2-3-9.C SELECT AHM HYBRID	-	AHM Hybrid Procedure: AHM 21-24-00 is selected as alternate mean of compliance of classic Task 21-24-01.
2-3-9.4 SUMMARIZE THE AHM AS SELECTED IN BOXES 2-3-9.C & D AND SUBMIT TO ISC FOR APPROVAL AND INCLUSION IN THE MEBE PROPOSAL	_	**AHM requirements / procedure** AHM Hybrid - AHM 21-24-01 (approved to address FC 1.1.1 leading to Task 21-24-01-00) Description: Recirculation Air Filter indication data readout for discard of filter per task 21-24-01-01 when indication limit is reached before 5000 FH. Data collection and analysis: to be executed per provisions in AHM 21-24-01 Procedure: GSE applicable/Personnel involved (Skill)/ Engineering Analysis/Maintenance Actions/Deviation information **MRBR Task 21-24-01-00** - description updated to include NOTE: there is AHM capability available to comply with this task - see AHM 21-24-01 **MRBR Task 21-24-01-01** - new task included and required in conjunction with AHM Hybrid - AHM 21-24-01 - task addresses FC 1.1.2 (with required periodicity of 5000FH)

AHM Candidate 1.2.1 - Recirculation air filter element failure (loss of filtration capability)		
2-3-9.1ARE THERE AHM CAPABILITIES THAT CAN DETECT NEED FOR LUBRICATION / SERVICING?	NO	There is no need of lubrication or service on Recirculation air filter
2-3-9.2 ARE THERE AHM CAPABILITIES THAT CAN DETECT DEGRADATION?	NO	The recirculation system does not have any sensor to detect the recirculation air filter element degradation (loss of filtration capability).
2-3-9.3 ARE THERE AHM CAPABILITIES THAT CAN DETECT HIDDEN FAILURE??	NO	The recirculation system does not have any sensor to detect the recirculation air filter element failure (loss of filtration capability).

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IMRBPB Position:	
Date:	
Position:	
Recommendation for Implementation:	

Status of the Issue Paper:	X	Active
		Incorporated in MSG-3 / IMPS (with details)
		Archived

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