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AHM Update

IMRBPB June 20, 2022

Agenda

- » Review of updates provided in Dec.
- » Overview current efforts underway with FAA Policy Innovation management and oversight
- » Round table rotation with primary stakeholders
 - » Boeing 787 update (Jeff Miller)
 - » Airbus update / approach (Oliver)
 - » SAE update on ARP development (Rhonda Waltham)
 - » IATA update (Dragos Budeanu)
 - » Airline Readiness
 - » ICAO monitoring of AHM developments (Airworthiness Panel, IATA WP)



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EMMC Action Item:

Proposed guidance for AHM / ECM data

March 4, 2022



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Updates since the May 2021 overview (Appendix A)

- » Advisory Circular 43-218 is progressing within the FAA's workflow system
 - » FAA management updated the subject late September during A4A's EMMC meeting.
 - » No content issues were holding up the AC and it was being monitored

- » The B787 has integrated IP180 within the PPH. AHM alternatives are expected to be derived.
 - » No IP180 text or decision tree amendments were needed.
 - » MRB chair (Michael Evans) has been updating FAA colleagues on respective developments. PPH signature is pending release of AC43-218 to prevent possible re-work. Boeing is hopeful for March 2022 approval.

Updates since the May 2021 overview (Appendix A)

- » Efforts continue within SAE's HM1 to progress ARP7122 currently targeted for draft review in Q1/2022
 - » The paper is expected to adapt the concepts contained within SAE ARP5987 (ECM only) more generically to allow application at the aircraft level.
- » There is a pre-IP180 use case we believe is worth a quick overview. It helps strengthen confidence in the common applied technology.
 - » ARP5987 included an example of AHM/EHM use to perform what FAA AC43-218 identifies as “airworthiness determination”



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Updates since the May 2021 overview (appendix A)

- » ARP5987 (“A Process for Utilizing Aerospace Propulsion Health Management Systems for Maintenance Credit”) documents a case of AHM use for airworthiness determination on a civil widebody aircraft
 - Engine TCH gained FAA approval for use of AHM (EHM) via an AMOC to the AD provisions requiring fixed periodicity of borescope inspections for distress of HPT.
 - The case demonstrates how AHM (ECM) procedure safely replaces a “traditional task” (in this case a repetitive SDI at a fixed interval)



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Appendix A

Content of May 2021
IMRBPB presentation

Background

References:

- ✓ IP180 approval by IMRBPB (27 April 2018) offered the following **recommendation for implementation:**

“Experience gained with its use will be reviewed annually and revisions introduced as necessary leading to a mature process in time for inclusion into the MSG-3 2021 revision. The basis of documenting the AHM experience and maturity should follow the recommendations in **paragraph 3** of this IP.”

- ✓ **Paragraph 3**
 - ✓ Related to **Assumption #1 (see page 2 of this IP)**, the AHM working group proposes development of new guidance material (e.g. Advisory Circular) for ground based processes as a means to create common practices for the industry.
 - ✓ Related to **Assumption #2 (see page 2 of this IP)**, the AHM WG proposes to Operators, Regulators and TCHs to support interim “certification for credit” methods if/as required for enabling AHM application within MSG-3 (e.g. Certification Memorandum; Certification Special Conditions). This is proposed as a means to allow the timely progression of MSG-3 revisions towards recognition of AHM early adopters and to mitigate the costly delay imposed by the long lead time required to develop regulatory provisions and/or guidance material.
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Background

References:

- ✓ **Assumption #1 (see page 2 of this IP)**
- ✓ Operator implementation of AHM for scheduled maintenance requires approval by the respective overseeing regulator. Programs with similarities to AHM capabilities (e.g. Flight Operations Quality Assurance (FOQA), Engine Condition Monitoring (ECM) may be a useful reference). These programs also involve on-aircraft sensing, data acquisition and processing, data transmission/transfer to ground personnel, ground based data analysis and associated actions. Local regulatory approvals are common for both FOQA and ECM programs (e.g. ECM required for ETOPS approval).

Background

References:

- ✓ **Assumption #2 (see page 2 of this IP)**
 - ✓ Gaining approval of AHM to be “certified for credit” for fixed wing aircraft can be successfully achieved via short term alternatives (e.g. special conditions per regulation 21.16) for early adopters, while industry stakeholders remain committed and work to develop, as needed, regulation and/or guidance material on long term. The use of AHM data within the MSG3 analysis depends on the system being accepted as certified for credit (similarly to HUMS acceptance via IP170) and is associated with recommendation to address the following:
 - Installation (qualification of the “on-board” and the “on-ground” segments, both in terms of hardware and software).
 - Qualification of the monitored parameters and thresholds to be representative of the directly or indirectly observed states and performance as a monitoring of system for degradation.
 - Qualification of off-aircraft (ground based) hardware and software utilized in monitoring.
 - Qualification of the Instructions for Continued Airworthiness of the AHMS itself.
 - Controlled service introduction validation.

MPIG related teamwork actions since IP180 approval

- » **Two(2) AHM working groups sponsored / formed by A4A**
 - » Operator working group – assessing practical issues of AHM implementation by operators
 - » MPIG AHM working group
 - » A subset of the original AHM working group team who authored CIP180
 - » Primary role to support AHM application & facilitate sharing of industry efforts
- » **MPIG invitation / participation extended to global propulsion manufactures**
 - » Understanding experience w/ECM and prognostics
- » **MPIG invitation / participation extended to global avionics suite manufactures**
 - » Understanding interface with on-board system dependencies



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Experience / Maturity since IP180 approval

- » **Results can be classified broadly in two(2) ways:**
 - » Direct
 - » Indirect
 - » **Direct AHM results could be defined as the existence of a real-world case involving approved , documented implementation of AHM procedures by an operator that satisfied an ICA via an AHM alternative. At least two(2) successes are needed**
 1. The TCH successfully achieved AHM approval
 - » Requires Cert / Mx authority & TCH collaboration
 2. The Operator successfully achieved Ops Spec approval
 - » Requires Operator & local Authority collaboration
- “Direct” AHM results remain a collective objective for all stakeholders



Experience / Maturity since IP180 approval

- » New type designs (albeit longer term) will embrace AHM application.
- » MPIG recognizes a more aggressive parallel path may also be pursued via a four (4) step approach
- ~~1. Publish IP180 content within the next version of MSG3~~
- 2. Operators & TCH isolate MSG3 (classic) tasks on select models w/beneficial AHM capability
 - a) Add AHM application to routine ISC agendas for discussion
 - b) Where justified run the level 3 logic within a pseudo IWG, supplement the MRB for limited scope cases (for the purposes of prototyping / trials / feedback)
- 3. TCH, Cert. and Mx. Authorities collaborate on approval options and conditions for success – linked to Assumption #2
- 4. Operator/s collaborate with local authorities in defining controlled scope service introductions and proof of concept demonstrations – linked to Assumption #1



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Experience / Maturity since IP180 approval

- » “Indirect” AHM results could be defined as all related AHM activities which enable, facilitate or support Direct AHM results.
- » There are a few good thing in this area to highlight
 - » FAA has developed an AC (43-218). The AC is in approval review stages. This work is clearly linked to Assumption #2 “stakeholders remain committed and work to develop, as needed, regulation and/or guidance material on long term.”
 - » One TCH (new type design) applied level 3 logic. The TCH was not intimately familiar w/IP180. They attempted to apply the decision tree with reference to the IP180 examples. The examples were for illustration purposes and lacked fidelity for practical use case application. This created some confusion. MPIG worked with the TCH over several months and subsequently recognized the examples could be improved to avoid future confusion. MPIG created CIP IND 2020-09 to clarify the examples. The CIP was discussed in the 1st virtual decision committee and it was agreed MPIG would withdraw CIP and re-identify the CIP as an MAP.
 - » Another TCH is actively underway with a re-analysis on one model to apply level 3 as noted in step 2. (b) on the previous slide



Experience / Maturity since IP180 approval

- » MPIG recognized SAE ARP5987 offered an approach for Maintenance Credit which may be adaptive. However, the papers scope was propulsion systems (ECM)
- » SAE / MPIG members supported our request to consider sponsoring additional work via the SAE Hm-1 Committee for IVHM to initiate a new working group to focus on a similar paper with aircraft level scope.
- » This approach seems well harmonized with the MSG3 which intends to ultimately recognize ECM,AHM and SHM under the larger umbrella of IVHM.



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