Aircraft Health Monitoring

FAA Perspective

Presented to: IATA Conference
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Introduction

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Definitions

• Defining Aircraft Health Monitoring
• Still a little unclear at this point, but generally, we see AHM as:
  – A system provided as part of the TC (or via STC) that can be employed by the operator to supplement or replace existing maintenance tasks or inspection intervals on an aeronautical product or part.
AHM functions

• We expect that a mature AHM system will provide the following functions:
  – Sensing - Monitor specific functions on the aircraft via sensors
  – Acquisition – Gather and correlate those readings (on A/C)
  – Transfer – Send those readings to mx personnel
  – Analysis - Interpret the readings
  – Then taking Actions from the analysis (in the form of Mx).

• While there have been successful efforts in each of these areas, AHM still needs to be proven as a system.
It’s really all about the P-F interval
Assumptions

• Like the above functions imply, AHM must have end-to-end control of:
  – Sensors (Accuracy, Reliability)
  – Transmission method (Timeliness)
  – Reading (Data Collection)
  – Analysis (Trends, identification of outliers)
  – Actions taken/operational flexibility (rational thought, not just “because the computer said to”)

• In the end, all this contributes to the overall system reliability and usefulness to the operator.
Certified for Debit

• In the past, the practice has been to use a sensor to determine the impending failure of a component or system, *in addition to*

• A “hard time” replacement that (by itself) would be adequate to address the safety concerns in that system or component.

• We refer to that as “certified for debit”, as the AHM would only “debit” from total allowable time.
Certified for Credit

• Certified for Credit, however, allows for an AHM sensor/system to adjust or completely replace an existing “hard time” or inspection interval, with adequate notification to the operator of the future potential failure of the component or system.

• Replaces one or more time/flight hour/cycle Mx actions, and allows –

  “Flying to impending failure”
Developments to Date
ECTM/ECM

- Engine Condition (Trend) Monitoring
- Oldest and most established efforts to date
- Still, though, no established standards – approved now on a case-by-case basis.
- “Certified for debit” – generally used to look for overages (over-speed, abnormal start, etc.) and early degradation/impending failure due to operations (hot section life)
Helicopters

- HUMS (Helicopter/Health Usage and Monitoring Systems) provide the most comprehensive set of instructions to date
- Advisory Circular 29-2
  - Miscellaneous Guidance 15
- Provides for “certificated for debit” and the beginnings of “certificated for credit” both.
- Requires standards for components.
Smaller (Corp./GA) Airplanes

- Many approaches from different OEM’s and product lines
- Again, generally “certified for debit” or an expansion of/addition to the Mx program.
- Looks to decrease total cost of ownership and increase availability by providing analysis of data (many times at OEM level.)
- May be provided by OEM as part of a comprehensive maintenance/support package.
Large Transport Category

- Newest aircraft (for example, A-380, B-787) generally have many sensors and systems that could meet the standards and assumptions stated earlier, but have not been certificated to allow their use in “certified for credit” models yet.
Current Position Overall

• We’re going to need a new wrench…
• …in the form of comprehensive, consistent guidance (and possibly rulemaking) on AHM.
MPIG/IATA Group

- Maintenance Programs Industry Group (MPIG) and International Air Transport Association (IATA) working together to propose inclusion of AHM principles inside MSG-3.
- Proposal will be made at the next meeting (April, 2018) of the International MRB Policy Board (IMRBPB) for potential inclusion in the next version of MSG-3 (Fall, 2018)
MRB/MSG-3 Impact

• Will add a new layer of analysis allowing for the use of AHM to either supplement or replace “classic” MRB tasking.

• Decision made there will depend on the failure causes that led to the original task (can an AHM system address them all?) as well as the tasking.

• Not meant as “mandatory”: always planned to become an operator-selected option.
Non-MRB Mx./Insp. Programs

• Similar concerns to MRB – each OEM has a responsibility to describe “scheduling information for each part… including the recommended periods” in the ICA.

• Part 43 and Part 91 mandate the use of a maintenance and inspection program operationally on all aircraft. The wording of those may require examination to better allow for AHM usage.
Regulatory Questions
Certification

• Reliability of the Sensors (Hardware)
• Analytic Software/Central Computers
• Transmission methods
• Possible changes to ALI/ICA requirements and AD wording?
• STC/In service – for existing fleets with sensors in place, can AHM be provided without design changes (or just via software)? On an STC basis?
Operational

- **Allowable delays in the system?**
  - How often must the system be “read”?
  - How long after a notification of an “impending” failure may the aircraft be operated?
  - What happens when a sensor breaks or is inaccurate? MMEL coverage?

- **Certification needed for personnel?**
  - Does the off-aircraft analysis of data require specialized knowledge?
  - …an A&P certificate? …a degree in statistics?
Rulemaking

• Not seen as inevitable or even likely, but may be needed to address the above concerns.

• There may be efforts in
  – certification (§§21, 23, 25, 27, 29, 33),
  – operational (§§43, 91, 121, 135)
  – or even personnel (§65).

• If so, the normal ARC/ARAC process will be used.
FAA Movement Forward

• Working on chartering a joint AFS and AIR “tiger team” to consistently examine AHM concepts across all sectors of US aviation

• This group will be tasked to create:
  – Temporary guidance for “quick adopters” or “pilot programs”, then
  – More comprehensive requirements for policy organizations to write guidance, and
  – Finally, monitor those products for consistency through their publication and implementation.
Timing and Planning

• Charter for group – this FY (hopefully this winter)
• Group first meeting – later this FY (Spring/Summer 2018)
• Creation of Guidance Documents – this FY and next (through 2019).
• Creation of Rulemaking (if needed) – starting in FY19, with normal process (3-5 years) to follow.
Conclusions

• There is much passion and pent-up desire to implement these AHM systems in a time-efficient manner.
• We understand that passion, and share it.
• With the above concerns addressed, the FAA sees AHM as a significant improvement in aviation safety, as it better informs an operator of the state of the aircraft, while simultaneously reducing Mx-related failures.
Questions?
Thank You!