

# Aircraft Health Monitoring & Maintenance Costs

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## AGENDA

### AHM & Maintenance Costs

AHM - The Basics

VAA – AHM System & Infrastructure

AHM Application to Maintenance Programs

Maintenance Task: Escalations using AHM

❖ **Task Analysis**

❖ **Cost Benefit**

❖ **Justifications**

Summary & What's Next?

## Aircraft Health Monitoring (AHM) – The Basics

- Modern aircraft are data-rich and designed with significant advancements in digital technologies
- Data transmitted from these modern-talking aircraft can be harnessed to enhance the aircraft health monitoring and prognostic maintenance capabilities
- Data streams into the AHM system can also be applied to optimise aircraft maintenance programs; and consequently a reduction in related maintenance costs

## VAA AHM SYSTEM: AHEAD PRO

- VAA utilises the functionality of AHEAD PRO - a system developed by Embraer to continuously monitor the status of aircraft in real time
- A computational web-based platform developed to support Health Monitoring processes within the airline operation, from data acquisition to time-to-failure prognosis



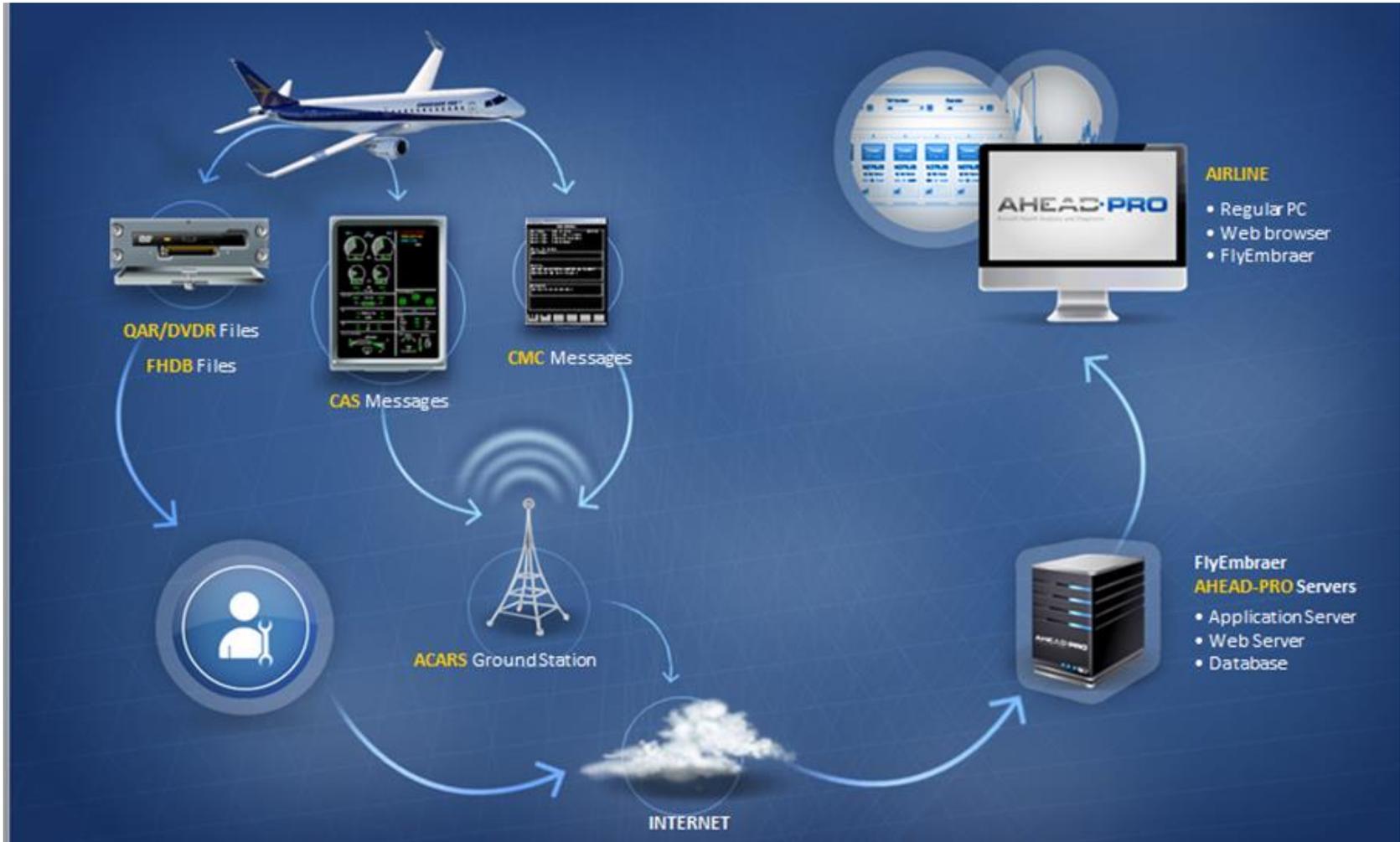
### Real-time Messages

Receives Information Messages in Flight

- + CAS and CMC messages;
- + Full flight coverage – gate to gate;
- + Includes messages inhibited to flight crew during flight;



# AHEAD PRO System Architecture



## AHM Application to Scheduled Maintenance

- **AHEAD PRO is integral to VAA aircraft health management processes with functionalities integrated as active features:**
  - ✓ **ACARS enabled aircraft receives Real-Time information while aircraft is still in flight – CAS & CMC messages**
  - ✓ **Display Aircraft fault messages in a real-time user-friendly Interface**
  - ✓ **System Trend monitoring via QAR data**
  
- **VAA utilized the functionality of the AHM system to analyse & implement an escalation of a candidate scheduled maintenance program task interval based on:**
  - ✓ **the accuracy of the AHM transmitted data**
  - ✓ **the real time availability**
  - ✓ **continuous assessment of system fault conditions**

## Maintenance Task Escalation using AHM

The following MPD task was selected and analysed for interval escalation using the **real time health monitoring** offered by the AHM system.



Maintenance Requirement ID	Maintenance Requirement Effectivity	Description	Man-Hours Total Number of Persons	Source	Periodicity (T:Threshold, I:Interval) Procedure Ref./ Position (Man-Hours)/ Skill Qty. Related Zone/ Acceses	Effectivity
72-00-00-001	ALL	VCK - MULTIFUNCTION DISPLAY (MFD) CHIP DETECTOR INDICATION Visual Check of Master Chip Detector indication on the MFD (Multi Function Display).	0.50 1	MRB 9	I: 120 FH <a href="#">AMM TASK 79-35-01-200-802-A/600</a> LH (0.25) RH (0.25) / PA (1) 221	ALL

Task Description:

**MPD 72-00-00-001: Visual Check of the Master Chip Detector Indication on the MFD (Multi-Functional Display)**

Current MPD Interval: 120 FH

VAA Approved Task Interval: 250 FH\*

\* Optimised to align with a scheduled maintenance opportunity

## Task Escalation : Analysis

Task interval escalation subjected to a comprehensive **analytical review process**.

### Engineering – Technical analysis

- Verified all previous messages were reported
- Verified all reported events originated with 72-00-00-001 and simultaneously visible through VA AHM system
- Verified the effectiveness of the AHM system

### AHM - Framework Analysis

- Confirmed chip detection metric is captured by AHM system
- Confirmed relevant 'Alerts' set up to advise if chip detected
- Work instruction set up for maintenance action when fault message is received

### Engineering - Reliability Analysis

- Compliance, Yield and findings were analysed
- Reviewed unscheduled findings related to task

## Task Escalation : Cost Benefit

Existing functionality within the AHM resulted in a reduction in maintenance cost

Task	72-00-00-001					
Description	Visual Check of the Master Chip Detector Indication on the MFD (Multi-Functional Display)					
	Interval	MH/Task	Annual Util (18x Aircraft)	# Compliances (Util/Interval)	# Tasks (Savings)	MH (Savings)
MPD Interval	120 FH	0.5	45090	375.75	195	97.5
VAA Interval	250 FH	0.5	45090	180.36		

### Cost Benefit:

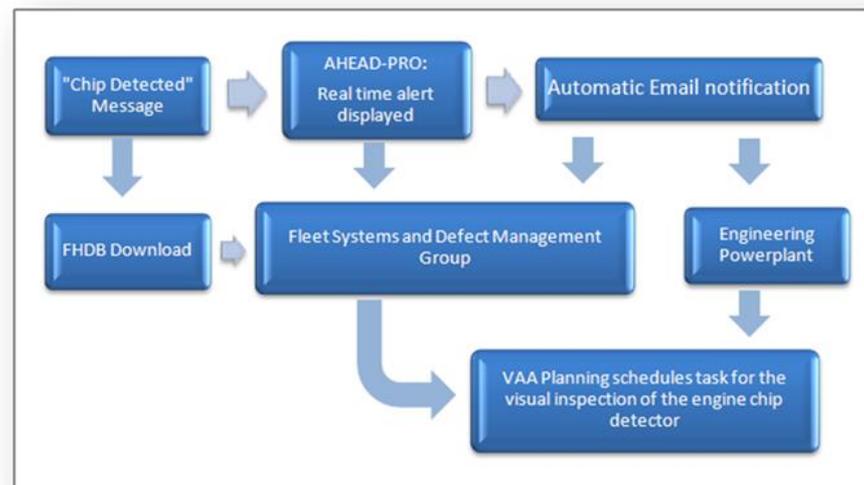
Fleet of 18x aircraft

- Savings of 195x scheduled maintenance events
- Overall (annual) savings of 97.5 MH

## Task Escalation : Justification

Escalating the task MPD 72-00-00-001 was therefore substantiated and regulatory approved by the following key elements:

1. Analysis process confirmed that the AHM system was designed to reliably detect faults and communicate the alerts in real time.
2. Cost benefit analysis indicated a savings in MH requirements with no risk to ongoing continuing airworthiness.
3. Introduction of a new process to address the fault condition into bench level work instructions, including maintenance actions to be initiated on identification of the Chip Detector Alert.



## Task Selections: Further Escalation Candidates

VAA proved the internal concept with the candidate task – *Maintenance inspections and associated costs can be effectively reduced by the accuracy of AHM functionality when set up to generate real time fault alerts.*

The next set of candidate tasks have been identified to analyse for potential escalation of task intervals based AHM functionality:

MPD Task #	Task Description	Task Interval (MPD)	Task Man Hours
21-51-01-001	RST - PACK FLOW CONTROL VALVE FILTER	7500 FH	0.9
21-51-10-001	RST - PACK BYPASS VALVE FILTER	3000 FH – P/N 820914-5 7500 FH – P/N -6 AND ABOVE	2.8
21-62-05-001	RST - TRIM AIR MODULATING VALVE FILTER	7500 FH	0.9
30-11-01-001	RST - WING ANTI-ICE VALVE	6000 FH	2.04
30-31-01-001	OPC - AIR DATA SMART PROBE (ADSP) HEATING -	16,087 FH	2.08
49-00-00-001	VCK - APU SYSTEM FAULT CODES	750 FH	0.5
71-00-00-002	VCK - ENGINE FAULT MESSAGES -	750 FH	0.5
36-10-01-001	RST - CROSS BLEED VALVE SUPPLY FILTER -	7500 FH	1.2
36-11-01-001	RST - HIGH STAGE BLEED VALVE FILTER -	7500 FH	0.64
36-11-06-001	RST - TORQUE MOTOR CONTROLLER FILTER	12,000 FH	3.00
36-11-09-001	RST - FAN AIR VALVE FILTER	7500 FH	0.82

## AHM as a Method to reduce Maintenance Costs!

- AHM technology deliver succinct technological advantages that provide effective and real-time aircraft health monitoring functionality.
- When these digital data streams are combined with reliable infrastructure set-ups, airlines can extract well defined credits for scheduled maintenance tasks as well as efficient prognostic defect management of aircraft systems and components.

## What's Next?

With clear operational and costs benefits for airlines, the industry stakeholders must :

- ✓ Consider tapping on the significant volumes of reliable aircraft digital data
- ✓ Develop policies, techniques and maintenance solutions
- ✓ Create AHM Data based maintenance program concepts
- ✓ Initiate an ISC stakeholder process to update the existing MSG-3 framework to include AHM capabilities



**Thank you !**