



# Maintenance of Tomorrow The AHM path from Airbus' Perspective

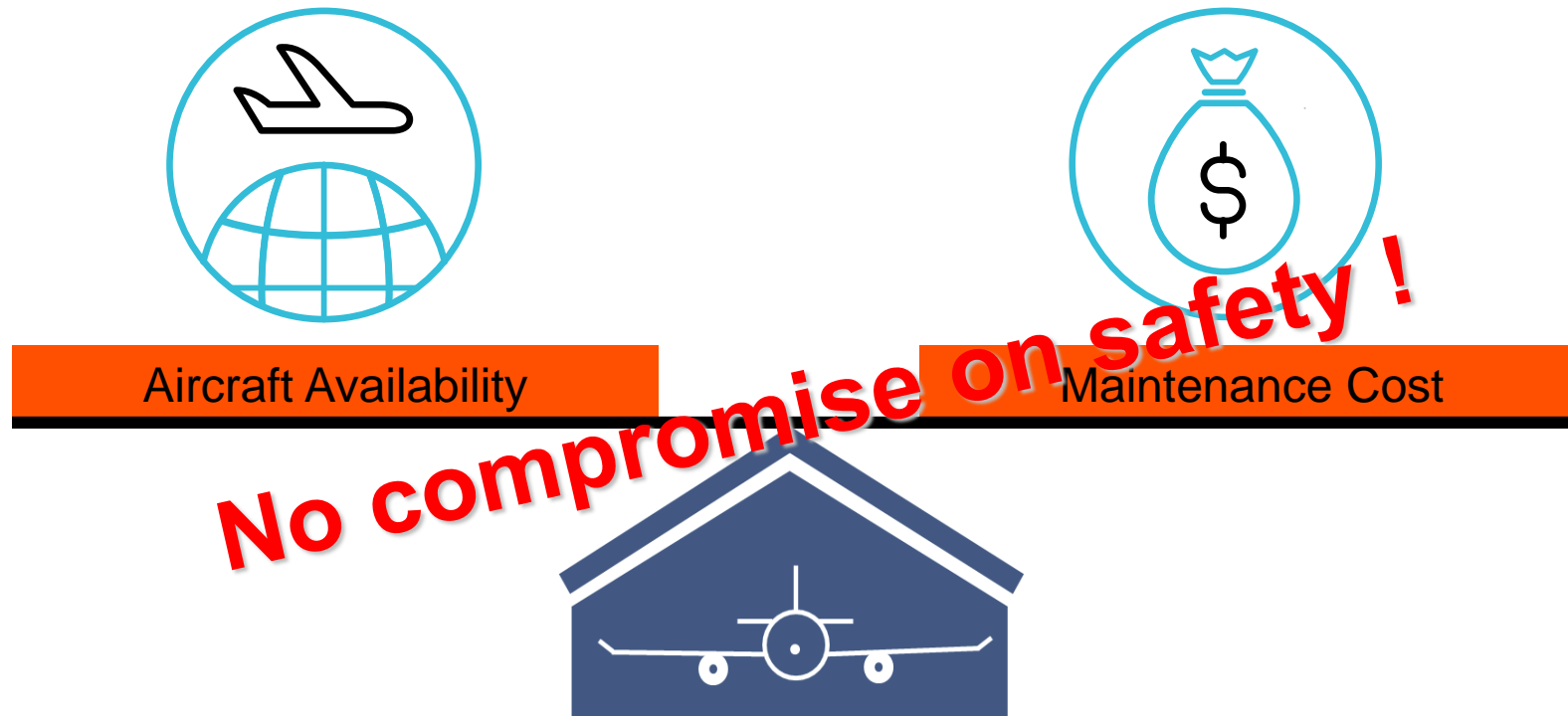
Oliver **WEISS** – Head of Maintenance Programs Engineering Systems

November 26<sup>th</sup>, 2018

5<sup>th</sup> Paperless Aircraft Operations and RFID Conference

**AIRBUS**

We have to find the right balance!



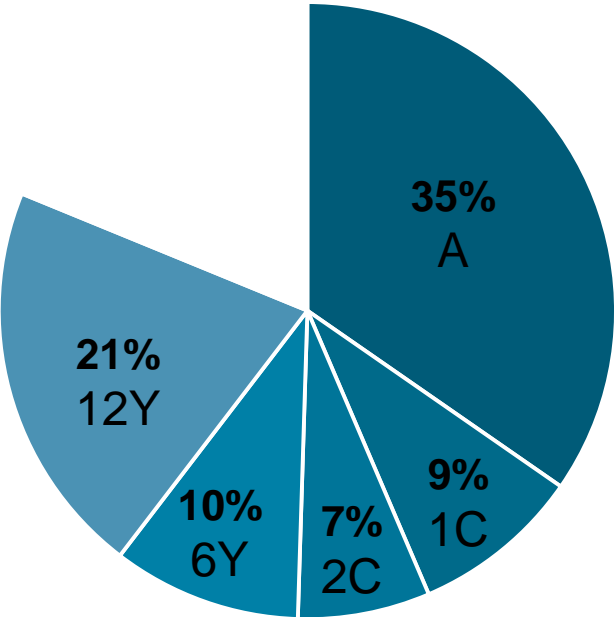
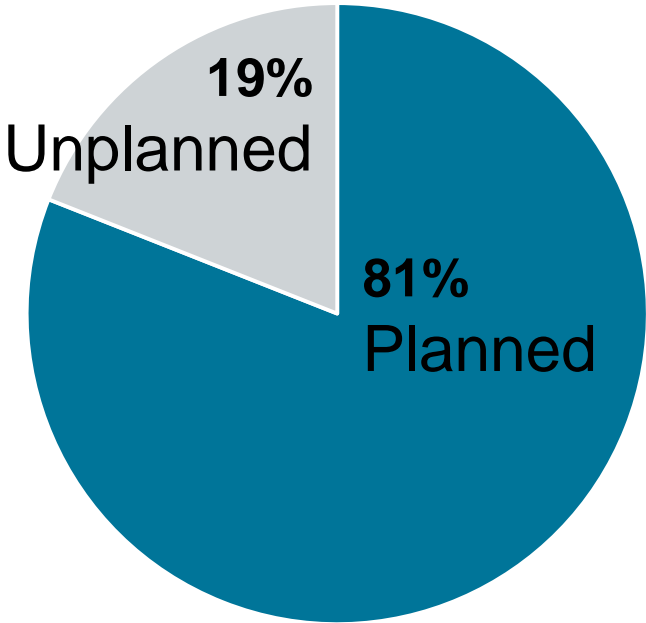
The best scheduled maintenance task is the one which does not exist!

## Our Mission

**Safe, reliable  
and efficient  
operation at  
minimum cost!**

# Significant potential of savings in planned maintenance

## Maintenance Unavailability\*



Example of  
Planned maintenance details

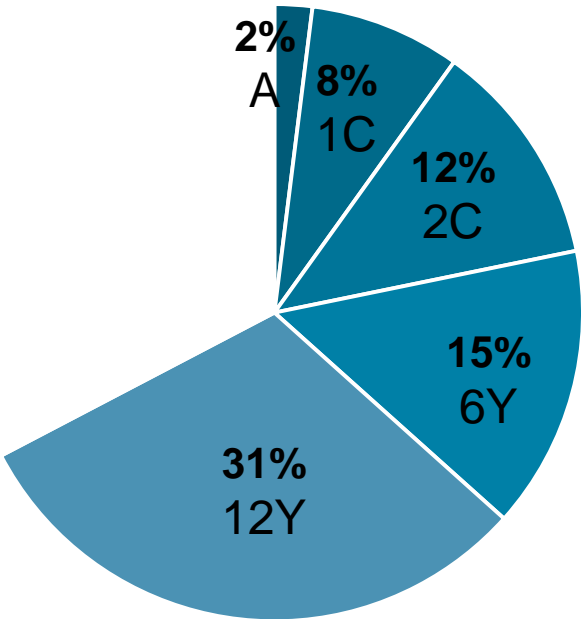
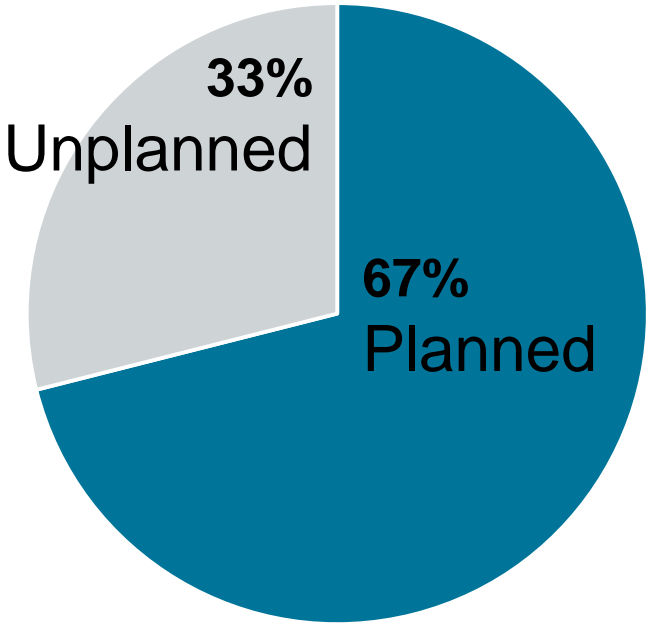
\*following IATA Aircraft operational availability document

## Less time in Hangar

Planned maintenance accounts for **81%** of the “**unavailability**” for a long range aircraft

# Significant potential of savings in planned maintenance

## Maintenance Unavailability\*



Example of  
Planned maintenance details

## Less time in Hangar

Planned maintenance accounts for **67%** of the “**unavailability**” for a narrow body aircraft

\*following IATA Aircraft operational availability document



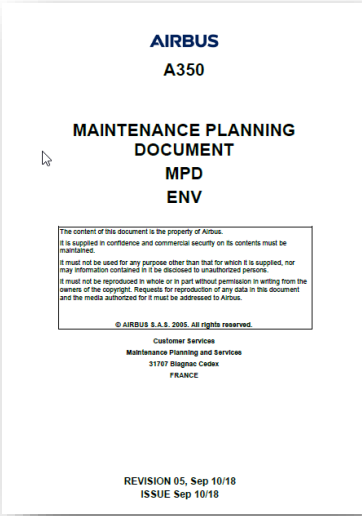
# The classic scheduled maintenance task



MSG3  
Methodology



Maintenance  
Review Board  
Report



Maintenance  
Planning  
Document &  
AMM



Job  
Instruction  
Card

## Bye Bye Dirty Fingerprint

About **90%** of  
systems scheduled  
maintenance tasks  
result in **no  
finding!**

## The classic scheduled maintenance task



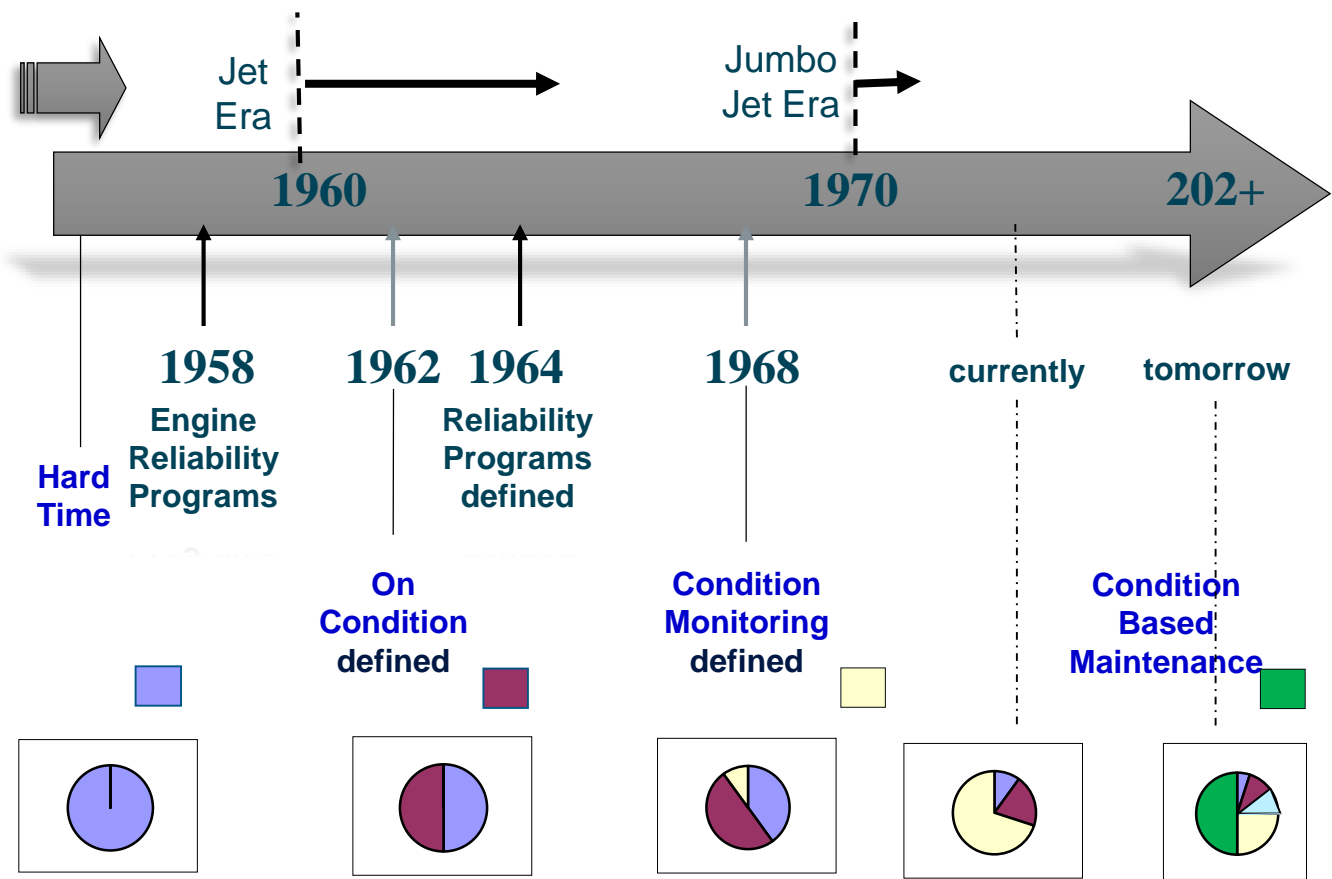
90% of aircraft ground time for systems scheduled maintenance does not change the condition of the aircraft!

## Let's kill the waste

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There must be a **better way** to assess systems performance.

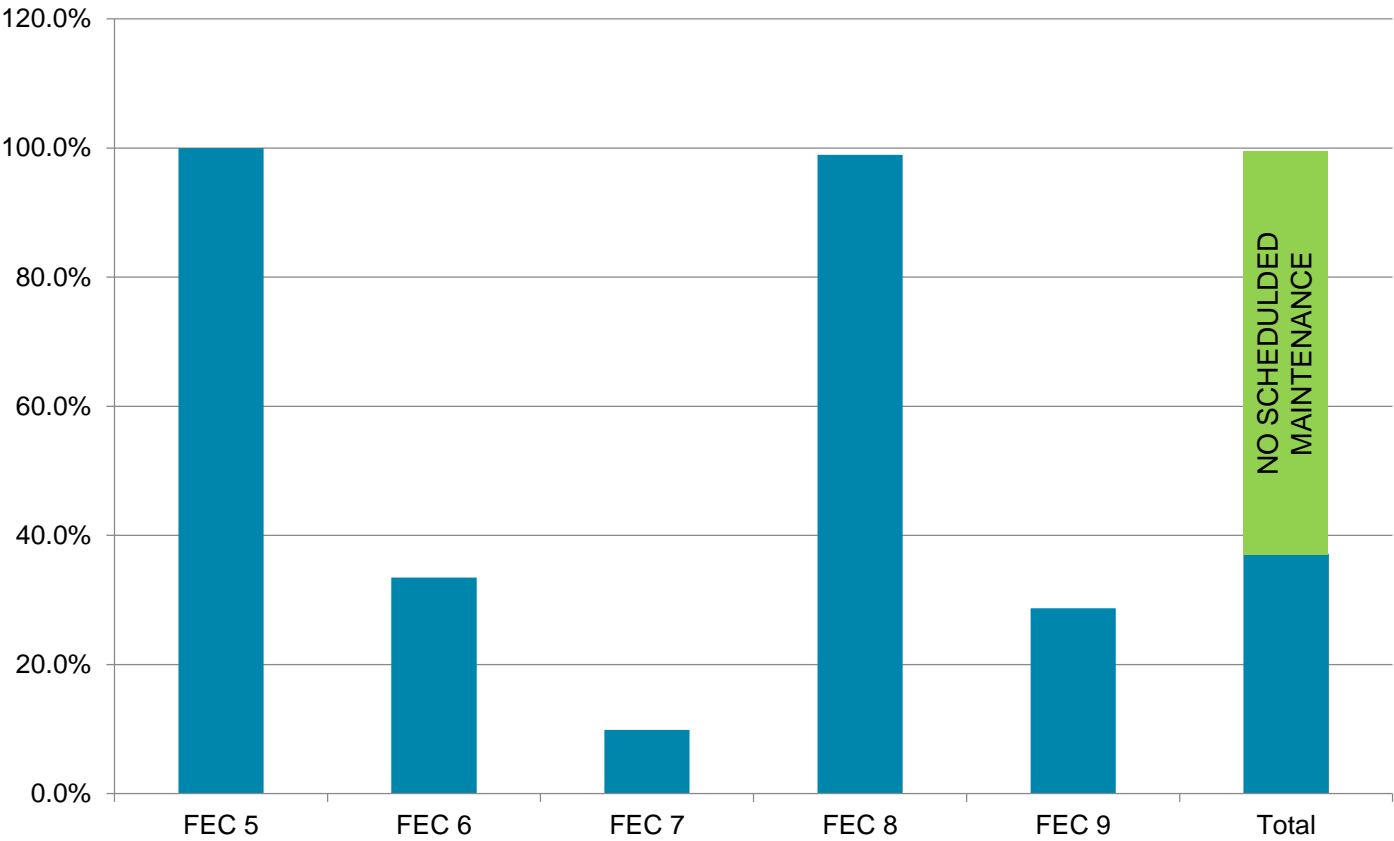
# From Hard Time to Condition Based Maintenance



## Hard Times are over!

History is telling us that **there is a future**, even on maintenance concepts.

# System functional failure with a scheduled maintenance task



MSG3 – Failure Effect Categories

FEC 5: evident/safety; FEC 6: evident/operational; FEC 7: evident/economical; FEC 8: hidden/safety; FEC 9: hidden/non-safety

The journey  
has started

For about **63%** of  
system functional  
failure **no  
scheduled  
maintenance  
task** has been  
selected.



The key factors to enhance aircraft availability  
by using Aircraft Health Monitoring  
are

# Technology & Big Data



Less time in  
Hangar

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Digitalization is the  
key driver

# A4A MPIG AHM Working Group results

*International Maintenance Review Board Policy Board (IMRBPB)*  
*Issue Paper (IP)*

Initial Date: 27 Apr 2018  
IP Number: IP180  
Revision / Date: 0

**Title:** Aircraft Health Monitoring (AHM) integration in MSG-3

**Submitter:** Industry (MPIG based on AHM WG proposal)

Applies To:	
MSG-3 Vol 1	X
MSG-3 Vol 2	X
DBPS	X

**Issue:**

MSG-3 logic does not currently make use of AHM.

Main stakeholders (i.e. Operators, Regulators and TCHs) agree that application of AHM within the MSG-3 process would improve aviation safety and reliability, provide the operator with improved awareness of the state of the aircraft and enable more effective and efficient maintenance programs.

The AHM technology has been successfully proven in commercial air transport aviation in three categories of applications:

- Engine Condition Monitoring
- AHM as part of operators reliability programs
- Credit for AHM applied to MRBR scheduled maintenance requirements (a limited category consisting of very few application cases)

See Appendix 1 to this IP for examples.

MSG-3 logic should be amended to realize the benefits from AHM capabilities in scheduled maintenance development and to create a consistent industry approach. Relevant industry standards have been considered in developing this IP (e.g. SAE documents ARP6803, ARP5120, ARP6275 and AS4831A).

**Problem:**

The problem areas identified in pursuing the above issue are:

- A systematic approach to connect AHM functionality with failure causes associated to scheduled maintenance requirements does not currently exist in MSG-3 vol1.
- Guidance material addressing AHM as an end to end system allowing credit to be taken to adjust intervals or completely replace a requirement is not available for fixed wing applications. It should be acknowledged that the scope and foundations of guidance material developed for HUMS integration in MSG-3 vol2 is significantly different.
- Industry is unable to realize the significant unsupplied benefits of AHM capabilities delivered by TCHs.

**Conditional Considerations:**

The following considerations condition the approach to address the problem stated above:

IP Template Rev 5, dated 28/04/2017

1

- An MSG3 update, described in a CIP (Candidate Issue Paper), has been developed by the MPIG AHM WG and presented to the MPIG (Maintenance Program Industry Group) in September 2017.
- The proposed solution is introducing a Level 3 analyses sheet to the existing MSG3 systems analysis methodology, which can be used optional by the TCH to identify a AHM (Aircraft Health Monitoring) capability as an alternative to a classic MRBR task.
- CIP has been successfully presented at the IMRBPB (International Maintenance Review Board Policy Board) meeting in April 2018 and published as IP180 “Aircraft Health Monitoring (AHM) integration in MSG-3”.

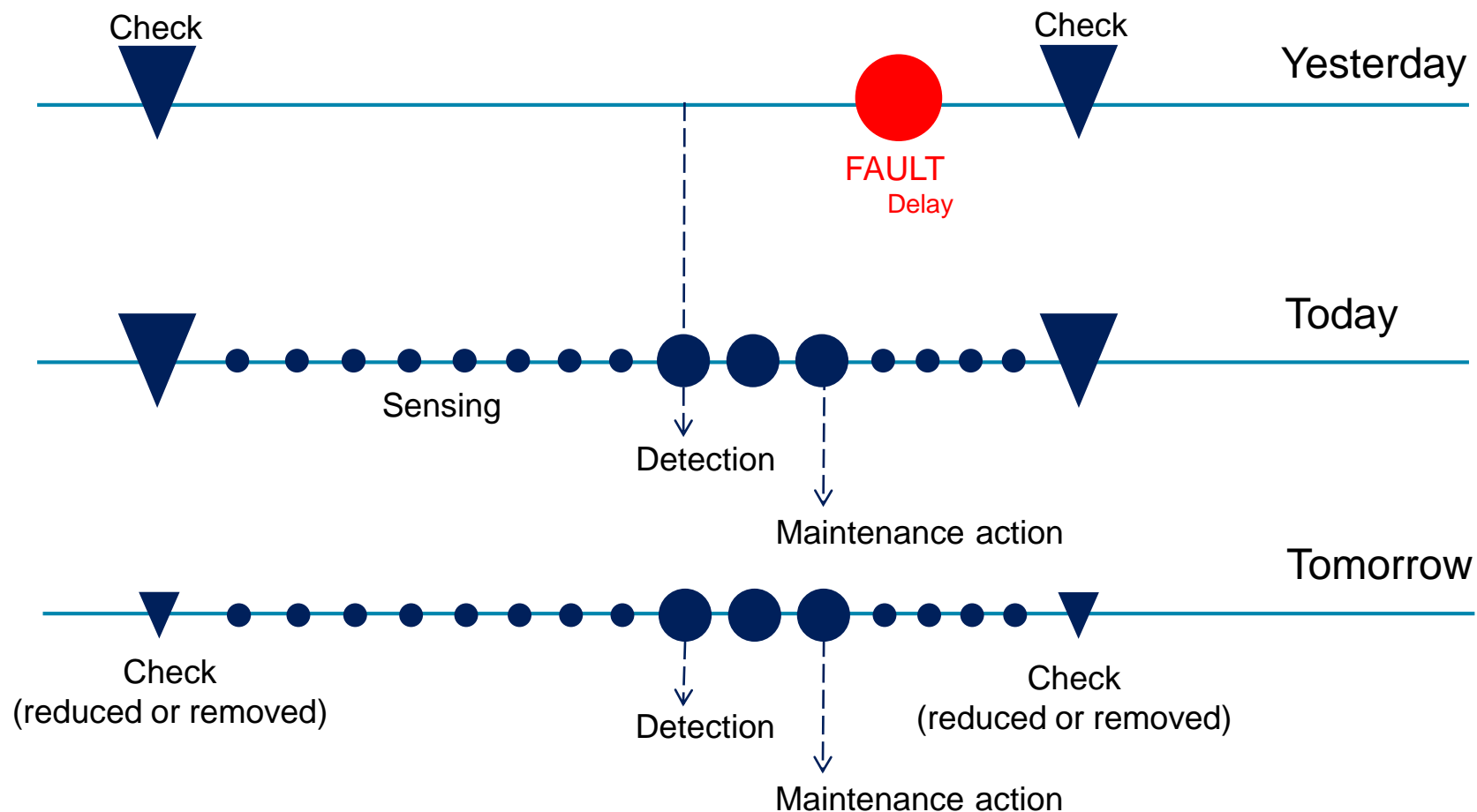


MSG3 is ready for AHM

Issue Paper 180

MSG3 methodology has been updated to allow **AHM** as an **alternative** to the **classic** scheduled maintenance **task**.

# Aircraft Health monitoring vs scheduled maintenance

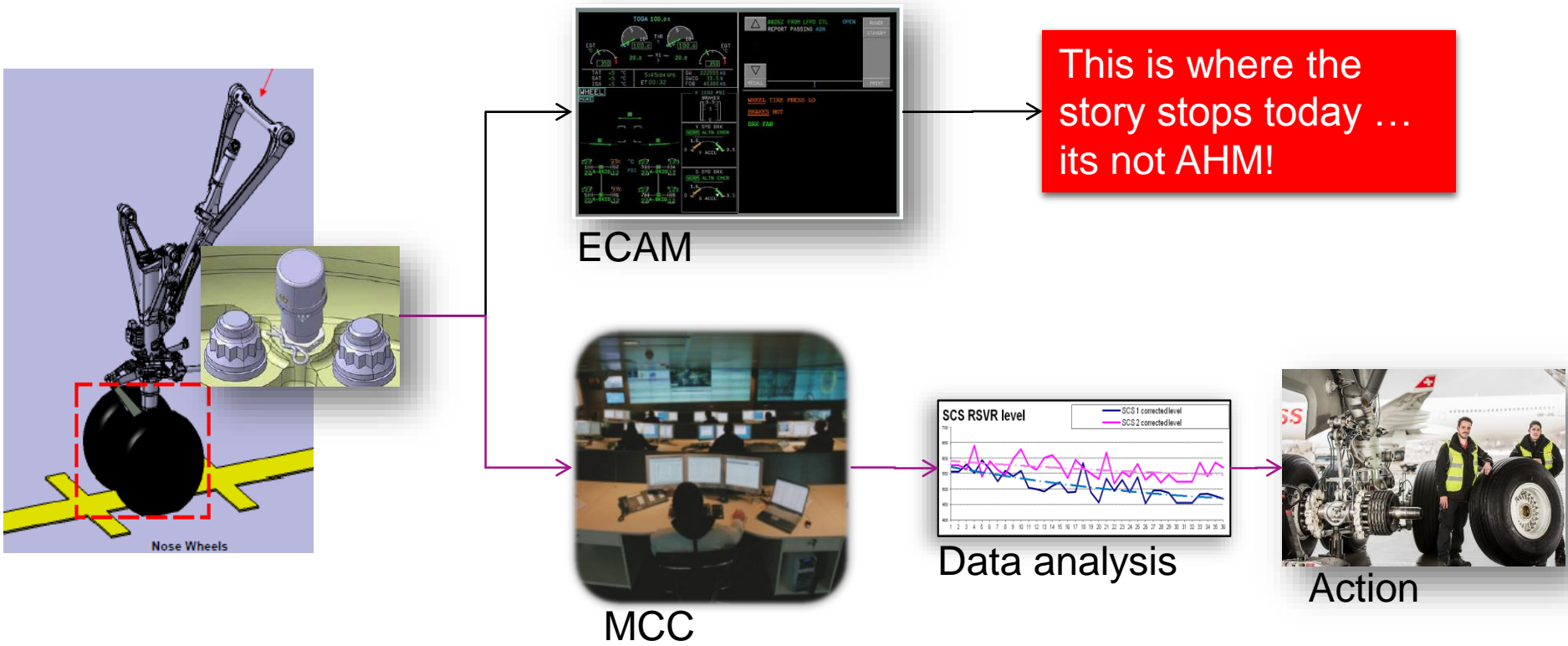


## The Principle

Aircraft Health monitoring

Reduce unscheduled and scheduled maintenance

# Aircraft Heath Monitoring it's more than a ECAM message!



AHM is the Sensing, Acquisition, Transfer, Analysis and Action/s taken (SATAA) with data generated from specific Aircraft systems measuring condition, reduced resistance to failure or function degradation. This unified process intends to optimize the timely scheduling of required maintenance prior to operational impact.

Watching  
from ground

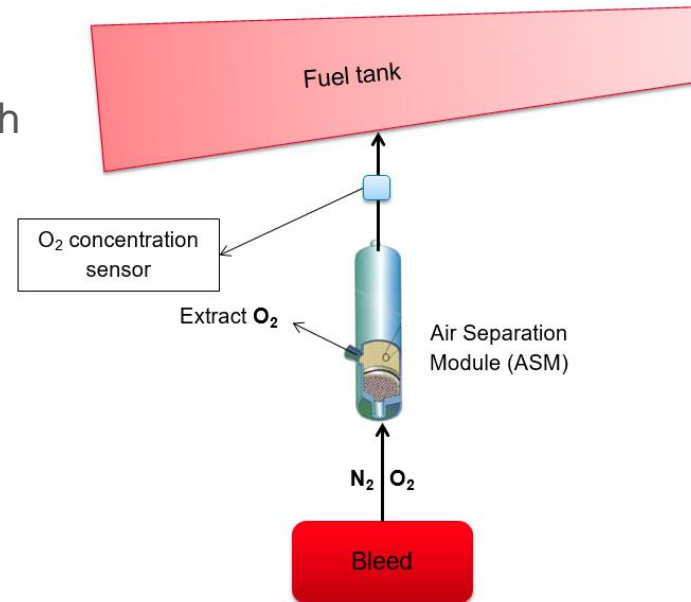
We have to  
**predict** and not to  
react!



# Fuel Tank Inerting System Description

- Aim of Fuel Tank Inerting System is to provide and maintain a Nitrogen Enriched Air (NEA) in the fuel tanks to minimize the risk of fuel tank explosion.
- O<sub>2</sub> concentration sensors are located downstream of each ASM. They are available in Aircraft Condition Monitoring System
- Uplink technology allows to capture these values at each flight from the ground
- **Scheduled maintenance task to replace the module at a fixed interval regardless of the condition.**

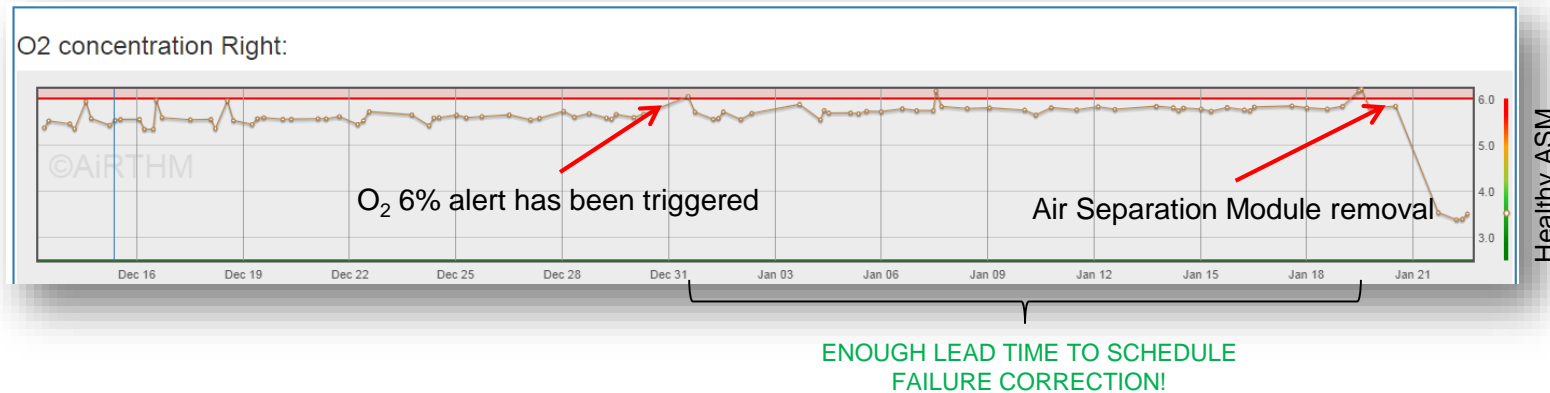
Dispatch Message is triggered if O<sub>2</sub> concentration  $\geq$  9%



## Let's take an example

### Early identification of system performance degradation.

# Fuel Tank Inerting System Description

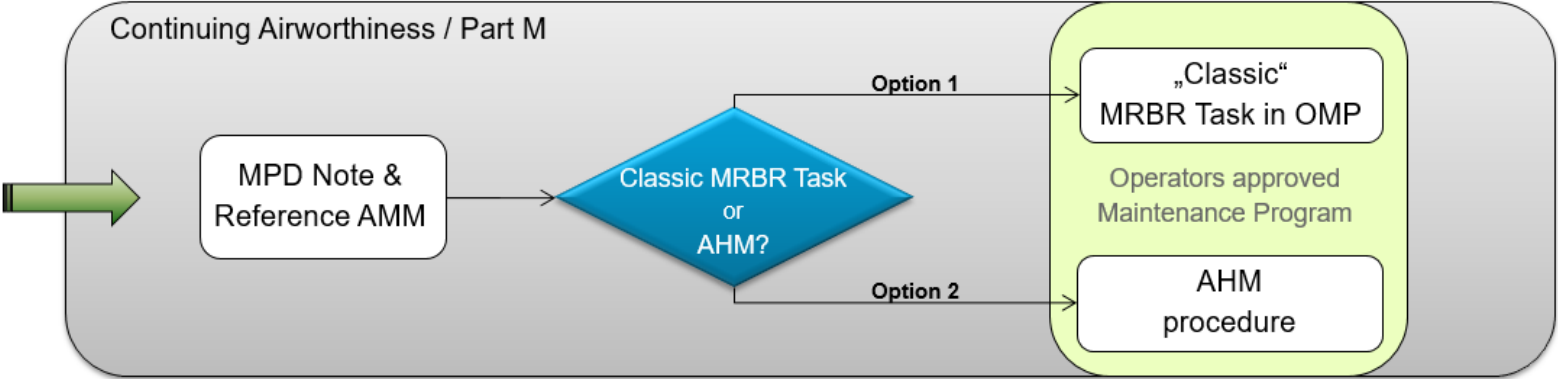


- Each flight, O<sub>2</sub> concentration is captured and sent via ACARS on ground for monitoring.
- O<sub>2</sub> concentration to be monitored by e.g. OPS center or engineering department.
- As soon as a O<sub>2</sub> concentration of more than 6% is detected, an alert is triggered and an advice is sent to e.g. MCC.
- Advice to schedule the replacement of the ASM within a certain timeframe.

## Let's take an example

We don't enhance the reliability of the item, but we **react when it is required**.

# AHM as an alternative means of compliance



Option 1

SECTION	TASK NUMBER	SOURCE TASK REFERENCE	ACCESS	ZONE	DESCRIPTION	100% INTERVAL	SOURCE	REFERENCE	APPLICABILITY
2-47	470000-00M02-01	MRB 470000-00002-01M	521AB 621AB	520 620	INERT GAS SYSTEM DISCARD AIR SEPARATION MODULES.	27000 FH	MRB 8	A350-A-47-11-61 -A0ZZZ-921Z-A	ALL

OR

Option 2

SECTION	TASK NUMBER	SOURCE TASK REFERENCE	ACCESS	ZONE	DESCRIPTION	100% INTERVAL	SOURCE	REFERENCE	APPLICABILITY
2-47	470000-00M02-01	MRB 470000-00002-01M	521AB 621AB	520 620	INERT GAS SYSTEM DISCARD AIR SEPARATION MODULES.	AHM	MRB 8	AHM PROCEDURE REF.: 470000-001	ALL

Operators approved  
Maintenance Program

It's the operators choice

The operator can choose between the classic task and the AHM alternative.

**Airbus is going to offer AHM as an alternative means to scheduled maintenance**

**Let's use the technology of today, we don't have to wait for a new aircraft type**

**Big data enable us to apply AHM as an alternative to existing tasks**

**We have to validate and to demonstrate the capability of AHM**

**Let's start now to get prepared for the future, there is a journey ahead of us**

**Powered by skywise.**

## In Conclusion

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Thank You!

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