



EASA

European Aviation Safety Agency

Realising Maintenance Credits

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Contents

- Concept of Maintenance Credits and Condition Based Maintenance (CBM)
- Impact of CBM Applications
- CBM and the Safety Assessment Process
- Fatigue Life Usage Monitoring – Flexible HUMS Boundaries
- AC29 MG15
- HUMS Application Workshop (**This Afternoon**)



Concept of Maintenance Credits and CBM (1)

“Maintenance Credit”: Usually refers to ways of reducing maintenance and operating costs using on-board monitoring equipment to provide condition or usage information.

- First generation of HUMS (early 1990s) were fitted as a modification to existing certified rotorcraft designs. The term “credit” originates from this time when HUMS applications replaced maintenance tasks in the ICA.
- Now we also need to consider new rotorcraft types which incorporate on-board monitoring to facilitate CBM and usage monitoring as a basic design objective.

Condition Based Maintenance (CBM): Where the condition of a component or system is used to determine what and when maintenance needs to be carried out.



Concept of Maintenance Credits and CBM (2)

Preventive Maintenance: Scheduled maintenance, CBM

Corrective Maintenance: Trouble shooting, rectification

Structural Usage Monitoring: Safe Life / Damage Tolerance

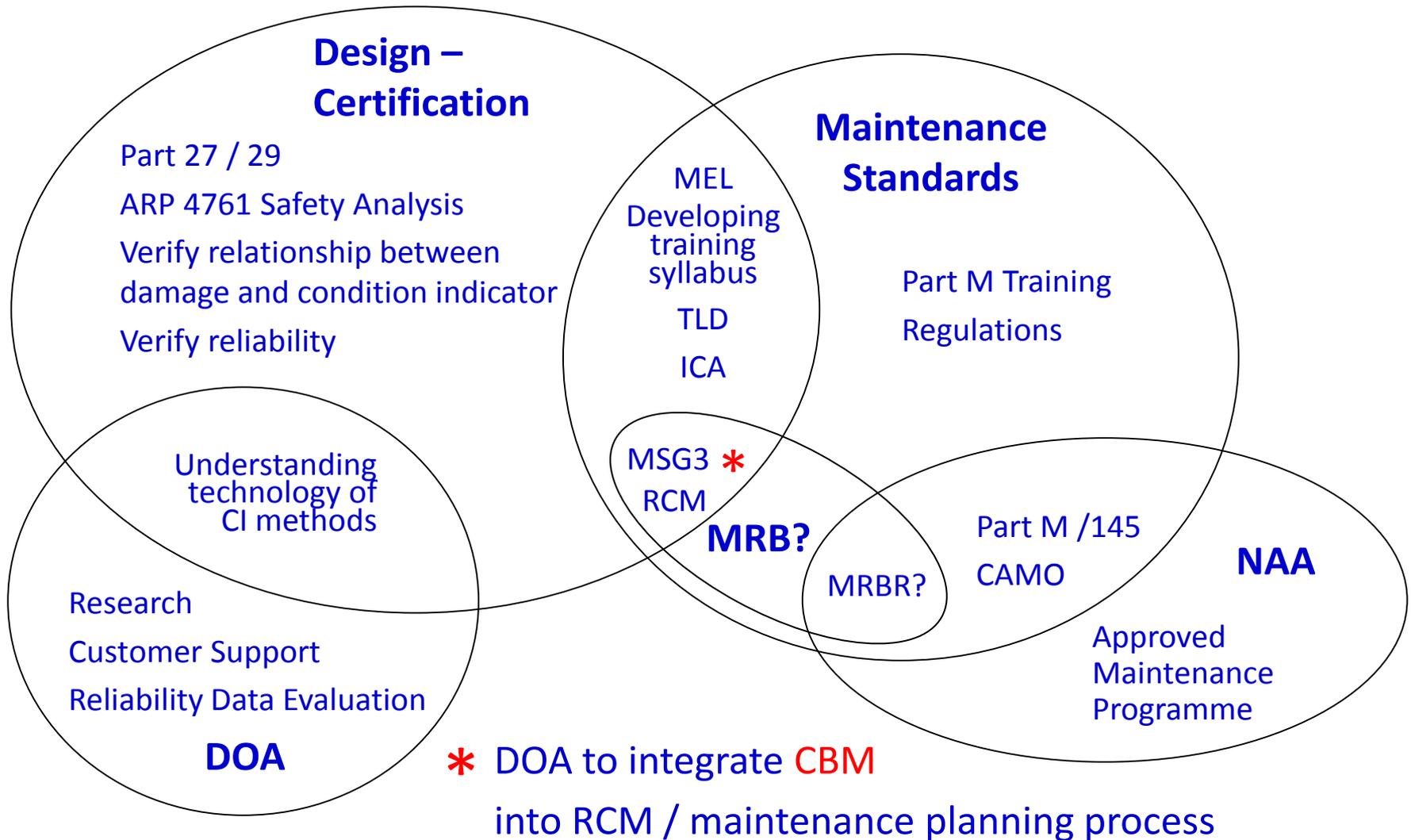
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|---|----------------------------|
| <ul style="list-style-type: none">* <i>Optimized maintenance actions (CBM)</i>* <i>Product life extension (UM)</i> | <i>Maintenance Credits</i> |
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|--|----------------------------|
| <ul style="list-style-type: none">* <i>On-board vibration health check</i>* <i>RT+B without need for check flight</i> | <i>Benefit or Credit??</i> |
|--|----------------------------|

- | | |
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| <ul style="list-style-type: none">* <i>Improved readiness and availability</i>* <i>Enhanced Vehicle safety and reliability</i>* <i>Accelerated product improvement</i>* <i>Defect identification capability</i> | <i>Operational Benefits</i> |
|--|-----------------------------|



Impact of CBM Applications





CBM and the Safety Assessment Process: Use of RCM to Achieve the Safety Objective

STEP 1 – Safety Assessment

Select Component / System Function for assessment



Perform FHA / FMEA and determine failure hazard severity classification



Safety Objective

Apply 29.1309 to obtain reliability / safety target
(e.g. Cat = 10^{-9} , Haz = 10^{-7} / flying hour)

STEP 2 – Design: Selection of Provisions for Safety

2.1 Design Provisions

e.g. Redundancy, QC, safety devices, strength and fatigue margin, flaw and damage tolerance, ops limitations.

+

2.2 RCM

Maintenance: Inspection, replacement, overhaul

On board monitoring: Temp. pressure, ODM, VHM



2.3



Does this achieve safety target? If not, identify additional maintenance tasks, operating limitations or consider means of mitigating effects of failure.

STEP 3 – Mitigation of Failure Effect (when necessary)

Design: RFM emergency procedures, crashworthy design, ditching capability, diversion capability.

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Operating Limitations: Weather, sea state, visibility, diversion opportunity, SAR availability.

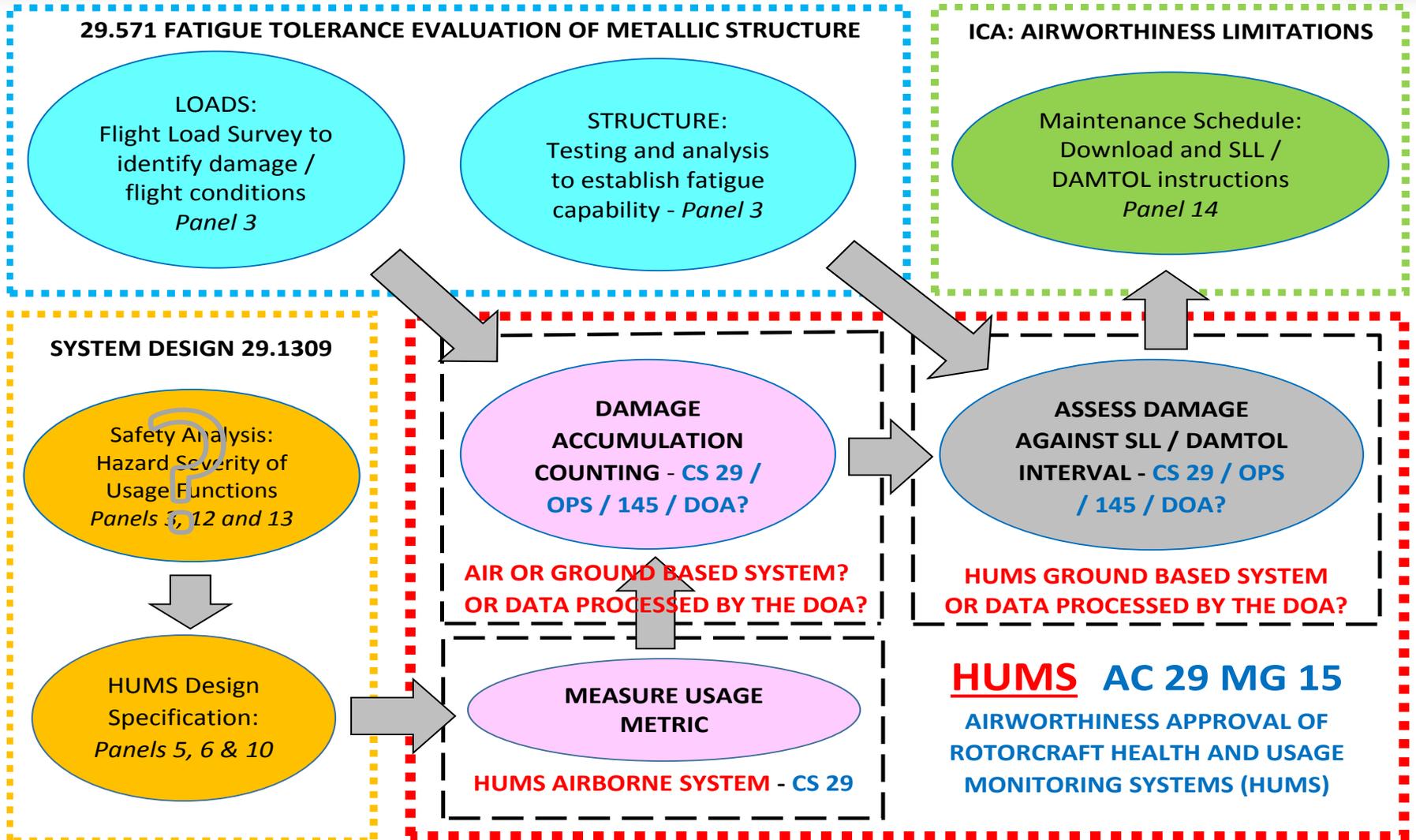


Does this achieve safety target? If not, go back to **STEP 2**.





FATIGUE LIFE USAGE MONITORING PROCESS: - FLEXIBLE HUMS BOUNDARIES





AC29 MG15

- FAA research has identified key areas for improvement of MG15.
- The application of airborne requirement to ground based systems is being re-evaluated.
- Requirements such as *DO-200A Standard for Processing Aeronautical Data* and *DO-330A Software Tool Qualification Considerations* are being considered for HUMS non-airborne functions.
- Time interval between downloading data and determining maintenance intervention - how can this best be used for verifying data integrity?
- Industry has significant experience with MG15 / use of COTS / HUMS performance / FAA research findings. Opportunity to share any lessons learned.
- EASA have organized a workshop to facilitate further discussion on this subject – see next slide.



WORKSHOP: HUMS Application Approval Process (“Maintenance Credits”)

When: Today, 14:00 to 17.00

Where: EASA Office – ROOM 06.017

To get there: Group leaving Hilton front door at 13.30. Then 10 minute walk (or use train if bad weather) to EASA Office.

14:00 – 14:15	OPENING AND WELCOME
14:15 – 14:40	REVIEW OF DISCUSSIONS AND COMMENTS FROM MORNING SESSION / IDENTIFICATION OF ISSUES & CHALLENGES FACING APPROVAL OF FUTURE HUMS APPLICATIONS
14:40 – 15:00	IDENTIFICATION OF THE SCOPE OF MAINTENANCE CREDITS ANTICIPATED BY INDUSTRY IN THE COMING YEARS
15:00 – 16:00	USAGE MONITORING APPROVAL PROCESS: EXPERIENCE WITH EXISTING REGULATIONS / POTENTIAL FOR IMPROVEMENT / FUTURE INITIATIVES
16:00 – 16:45	OPEN DISCUSSION / WAY AHEAD / NEXT STEPS
16:45 – 17:00	CONCLUSIONS



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Questions?

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Additional Slide 1: Reliability Centered Maintenance

Reliability Centred Maintenance (MSG-3): Objective is to monitor, assess, predict and generally understand degradation of physical assets in order to determine the optimum mix of applicable and **effective maintenance activities** needed to sustain the operational reliability of systems and equipment while ensuring their safe and economical operation and support.

=> IVHM Applications extend the choice of **effective maintenance activities** which are available for an RCM project.