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Health and Usage Monitoring System (HUMS) Certification under the Defence Aviation Safety Regulations (DASR)

Adrian Jackson[1], Wing Commander Nathan Poyner[2], James Craigie[1] and Stuart Cogan[1]

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[1] QinetiQ

[2] Defence Aviation Safety Authority

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Outline

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Australian Defence Aviation Safety Authority
- an independent aviation safety assurance organisation

- The military equivalent of the Civil Aviation Safety Authority + Australian Transport Safety Bureau (Aviation)

- Functions
  - Regulations and Policy
  - Promotion, Education & Training
  - Set standards, certify organisations, people and products
  - Conduct oversight and enforcement of organisations / products
  - Independent Investigative Capability (ICAO Annex 13)

ICAO State Safety Program

- Scope
  - Initial Airworthiness (Design, Certification, and Production of aircraft)
  - Continuing Airworthiness (Maintenance, Training, Licences)
  - Flight Operations (including UAS and Simulators)
  - Air Navigation Service Providers
  - Aerodromes (Certification and Aerodrome Operator)
- Future scope
  - Defence Space regulator

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DASA definition of HUMS

- HUMS is a very generic term – working definitions used by DASA:
  - HUMS: any system that performs aircraft usage or health monitoring functions in an automated or semi-automated manner
  - Usage Monitoring functions: include those that determine life accrual or other relevant aspects of service history
  - Health Monitoring functions: include those that monitor material condition, including detecting incipient failures or degradation

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Defence HUMS Applications

- DASA currently does not mandate use of aircraft HUMS

- General HUMS use-cases (current and future)
  - Tracking life consumption (often complex for military aircraft)
  - Source of data for continued airworthiness assessments or Reliability Programme
  - Supplementing standard maintenance program
  - On-condition management
  - Integrated into safety case for certification of systems

- Historical approach to ‘certification’ / ‘approval’ of HUMS by DASA has been ad-hoc

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HUMS Certification Challenges

- General challenges faced by safety authorities worldwide
  - Traditional Type Certification scope (on-board systems only)
  - Lack of standards
  - Verification
    - How much is enough?
    - Need real data to fully test system
- DASA-specific challenges
  - Defence is very rarely a prime customer for new aircraft
    - Various certification pedigree (various airworthiness codes, sometimes no recognised code)
    - Aircraft / system already certified by someone else
    - Understanding approach and involvement of other safety authorities in HUMS certification
  - Knowledge within Defence community

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What other Safety Authorities are doing

- US Federal Aviation Administration (FAA)
  - Installation of HUMS voluntary
  - FAA Advisory Circular 29-2C Miscellaneous Guidance 15 *Airworthiness Approval of Rotorcraft HUMS*: guides applicants when airworthiness 'credit' is sought
- European Union – European Aviation Safety Authority
  - Installation of HUMS largely voluntary
  - Rotor and drive system Vibration Health Monitoring (VHM) capability mandatory for certain helicopter types for operations in hostile environments (refer EASA SPA.HOFO.155)
  - CS 29.1465 *Vibration Health Monitoring*: applies for mandatory or voluntary helicopter VHM applications
  - Acceptable Means of Compliance (AMC) 29.1465: provides good detail on helicopter VHM certification

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What other Safety Authorities are doing

- CASA
  - Installation of HUMS largely voluntary
  - Part 133 (Air Transport Operations—Rotorcraft) Manual of Standards requires engine Usage Monitoring System (UMS) for Performance Class 2 with Exposure operations
    - CASA Advisory Circular 133-02 provides some guidance for engine UMS
- US Military
  - Installation of HUMS voluntary
  - Requirements that could apply to HUMS appear within broader standards (e.g. US Army ADS-79-HDBK)

Key takeaways:

- **HUMS capabilities are not mandatory besides some transport-category helicopter operating scenarios**
- **No comprehensive and adaptable framework for HUMS certification exists**

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What DASA is doing

- Maintain policy that use of HUMS for Defence aircraft is encouraged, but voluntary
- Where HUMS are used, ensure robust and flexible approach is taken to HUMS certification
- Currently developing a principles-based framework for HUMS certification under the Defence Aviation Safety Regulations (DASR)
  - Understand state-of-art and not reinvent the wheel
  - Ensure principles align with main players (EASA, FAA)
  - Likely to be published as a new DASA Airworthiness Design Requirements Manual (ADRM) Chapter, with accompanying Advisory Circular for guidance

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Draft DASA HUMS Certification Principles

- Where HUMS functions have a potential influence on airworthiness, then the HUMS, inclusive of the performance of such functions, must be certified and approved by DASA
- System safety analysis must be conducted for the end-to-end HUMS where the HUMS functions have a potential influence on airworthiness
- HUMS certification must demonstrate sufficient levels of system integrity, commensurate with the criticality of the HUMS functions
- Instructions for Continuing Airworthiness and other documentation necessary to support the operation and maintenance of the HUMS, and use of the HUMS outputs for the intended purpose(s), shall be developed

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Summary

- Installation of HUMS remains largely a voluntary undertaking by aircraft OEMs and operators
- DASA encourages, but does not mandate, use of HUMS on Defence aircraft
- Many and varied potential HUMS use-cases for Defence aircraft
- Defence acquires aircraft from a variety of sources, and hence varied prior certification approaches
- DASA needs a robust and flexible approach to HUMS certification
- DASA developing a principles-based framework for HUMS certification and accompanying guidance

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QUESTIONS