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Software Design Acceptance and the C-130J Block 6.1 Upgrade

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Overview

- The C-130J
- The C-130J Block Upgrade Program
- The Block 6.1 Upgrade
- Certification Basis used for compliance findings
- Software Design Acceptance Activities
- Compliance Finding Challenges
 - Use of RTCA/DO-178B
 - Recognition of Prior Acceptance
 - Compliance Finding Agency Competency
 - Raising and Managing Issue Papers





The C-130J

- Four engine, turbo-prop, medium airlifter
- 12 aircraft in RAAF fleet
- Roles – Inter and Intra theatre Logistics Support, Airborne Operations, Aeromedical Evacuation, Search and Rescue, Special Operations, Training





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C-130J Block Upgrade Program

- Established by C-130J owner nations – currently includes United States, United Kingdom, Australia, Italy, Denmark, Canada and Norway
- Provides regular, rolling updates throughout the life of the aircraft, addressing equipment obsolescence and new capability requirements
- Prime Contractor is Lockheed Martin Aeronautics – the OEM
- Establishes a common set of functional and performance requirements
- Each nation can add their own ‘national unique’ requirements as desired
- Common costs are shared proportionally to the user’s fleet size – ie Australia pays about 6% of the common core bill



What's Block 6.1

- Common effort between United Kingdom, Denmark, Italy and Australia
- Built from the United States Block 6.0 Build
- Hardware Changes include:
 - New Mission Computer
 - Upgrade IFF for Enhanced Mode S
 - Terrain Awareness Warning System (TAWS)
 - Upgrade to Intercom Central Switching Unit for TAWS messages
 - Upgrade to Auxiliary Hydraulic Pumps for High Altitude Cargo Ramp Door operations
 - Firearm Safe
 - Removal of OLMU (RAAF unique)



What's Block 6.1 (cont)

- Software Changes include:
 - Migrate TOLD calculations from CNI to MC
 - Ground Collision Avoidance System OFP modification
 - MC update to Advisory, Cautions and Warning System
 - MC update to Electronic Circuit Breaker data tables
 - MC updates to diagnostic and maintenance software
 - MC update for Propeller data capture
 - MC update for Missile Laser Warning System
 - CNI Processor OFP to common multinational build
 - CNI Track Offset
 - CNI update to CARP, Chute and Ballistics data



Certification Basis

- RAAF C-130J Certification Basis comprises airworthiness requirements from FAR Part 25 and military airworthiness standards (e.g. MIL-S-5700 and DEFSTAN 00-970)
- FAR 25.1309
 - SAE ARP 4754
 - RTCA/DO-178B





Software Design Acceptance Activities

- PDAS
- Software Safety Program
- Compliance Findings
- Design Acceptance





Use of RTCA/DO-178B

- RTCA/DO-178B chosen as the benchmark for assessing Block 6.1 software products and their development processes in support of making a compliance finding against FAR 25.1309
- LM Aero didn't make it easy in assessing compliance against RTCA/DO-178B
- Satisfaction of objectives within RTCA/DO-178B require judgement
- Breadth of design change

LESSON – Liaise with SCI1 **early** and **often** in your compliance finding effort!



Recognition of Prior Acceptance

- PDAS and CBD had intended use of USAF and RAF acceptance/certification for a claim for RPA
- RPA from USAF for Block 6.0 elements
- RPA from RAF for Block 6.1 elements
- Challenges in defining and assessing differences in CRE
 - Functionality
 - Software architecture (data and control flows)
 - Non-interference

LESSON – RPA can sometimes be more trouble than it's worth!



Compliance Finding Agency Competency

- Compliance findings require professional engineering judgement
- Understanding RTCA/DO-178B is no small feat
- Complexity of design change
- Safety criticality of affected systems and functions
- Competence of LM Aero
- Resources and continuity of ALSPO corporate knowledge

LESSON – SCI-DGTA Reference Paper on Compliance Finding Agency Competency is very useful



Raising and Managing Issue Papers

- Resulting number of non-compliant areas
- Raised several Issue Papers to refer the risk to the relevant Operational Authority
- Difficulty in analysing the risk
- Challenge in translating software related deficiencies and risk to AVRMM model
- Challenge in ensuring actions are managed to closure

NOTE - Aircrew will always be tempted to use the Service History card as a mitigation to software risk



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Questions?