Royal Canadian Air Force A310 Flight Management System Testing

Captain Peter Connolly
• Background
• Players
• Risk Management
• Execution
• Lessons Learned
• After Action

So… where’s the collective?
Background

• The RCAF A310 (CC150)
  – VIP Transport
  – Troop or Cargo Transport
  – Strategic AAR (only 2 modified)
Background

• Why were we replacing it
  – OEM FMS installed in 1986
  – limited navigation database memory
  – limited processing power
Background

• FMS already had TSO for another aircraft
• Limited TSO for A310
• Needed TSO that included vertical coupling
• RCAF providing aircraft for testing
Crew

• RCAF
  – Myself
  – Maj Duncan Reid
  – Capt Steve Chokly
  – WO Vautier

• Company A
  – Contractor Test Pilot
  – Engineer 1
  – Engineer 2
Crew

• Other
  – Mr. Klaus-Dietrich Flade
  – Mr. Michel Brulotte TC Test Pilot (Helo)
  – Mr. Waldemar Krolak, TC FTE
Risk Management

- Spd capture/maintenance
- Min spd capture/maintenance
- Max spd capture/maintenance
- Performance during approach and GA
- Alt capture/maintenance
- Throttle setting capture
- HMI of FMS display and PFD
Risk Management

• Unexpected/Anomalous Input
• Hard-Over During Coupled Approach
• Aircraft Radio/Navigation System Anomaly
• Overstress from excessive input @ high spd
• Overstress due to resonant oscillatory input
• Unsafe TO/Land due to aircraft unfamiliarity
• Improper response to Aircraft Emergency
• Loss of Situational Awareness
Risk Management

- Simulator Testing – Two significant deficiencies
- Take-off speed anomaly
- Inadvertent stall
Risk Management

• Inadvertent Stall
  – Min speed protection will not be assessed <10000 ft AGL
  – min speed of Vls-5
  – stall procedures reviewed in simulator and prior to first flight
  – decelerations within 5000 ft will be <30 KIAS
Execution

• Lost V1 on speed tape during Take-off
• Difficulty maintaining minimum speed (Vls) in the climb
• Difficulty maintaining maximum speed (Vmo) in descent
• Incorrect thrust commands during GA
Execution

Hold Set, Tgt spd drops to Green dot 238/259, aircraft pitches up to decel

Insufficient Authority to decrease pitch attitude while increasing thrust

Set to climb to 36K ft, 327 IAS

A/P disconnected, aircraft recovered

Mach Buffet
Execution

• Green dot changes with altitude
• Deceleration maintenance
• AFCS control authority vs max ROC
Execution

- Testing ceased
- No further testing until the next design cycle
Lessons Learned

- Simulator Testing
- Positive
  - Did it
- Negative
  - broke the normal design cycle due to project pressures
Lessons Learned

• Qualified Personnel
• Positive
  – Approvals
  – Right wording in the RA
• Negative
  – Safety Pilot
Lessons Learned

• Risk Management

• Positive
  – Briefed it as per SOP
  – Had the right people in the seats primed to recover the aircraft

• Negative
  – Did not consider all ways of entering the slow speed regime
After Action

• Spiral 2
  – Deficiency not yet rectified, but better
  – TSO not achieved
• Spiral 3
  – TBC next week (cross your fingers)
Summary

• Simulator testing – do it
• Respect the normal design cycle
• Qualified personnel with boundaries
• Consider safety pilot for cockpit systems testing
• Risk Management – do it
• Consider all the ways which your hazard can manifest itself
Questions?
Happy 4\textsuperscript{th} Birthday
Ainsley