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

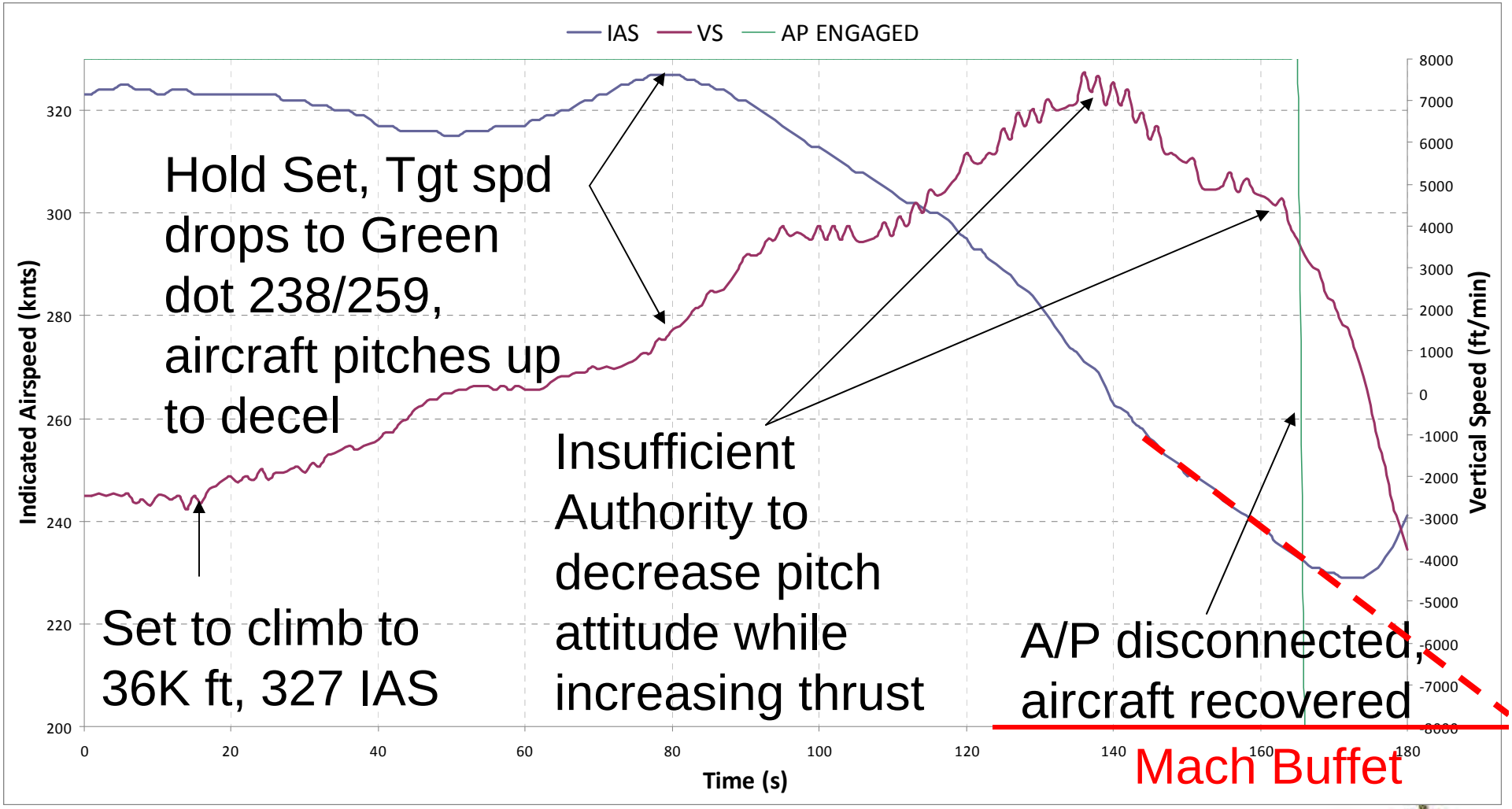
Risk Management

- 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


IAS
VS
AP ENGAGED
Indicated Airspeed (knts)
Vertical Speed (ft/min)
Time (s)
Hold Set, Tgt spd drops to Green dot 238/259, aircraft pitches up to decel
Insufficient Authority to decrease pitch attitude while increasing thrust
A/P disconnected, aircraft recovered
Set to climb to 36K ft, 327 IAS
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 4th Birthday
Ainsley