FAA Safety Analysis

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Main points

- MCAS allows maintaining positive column forces up to and during a stall

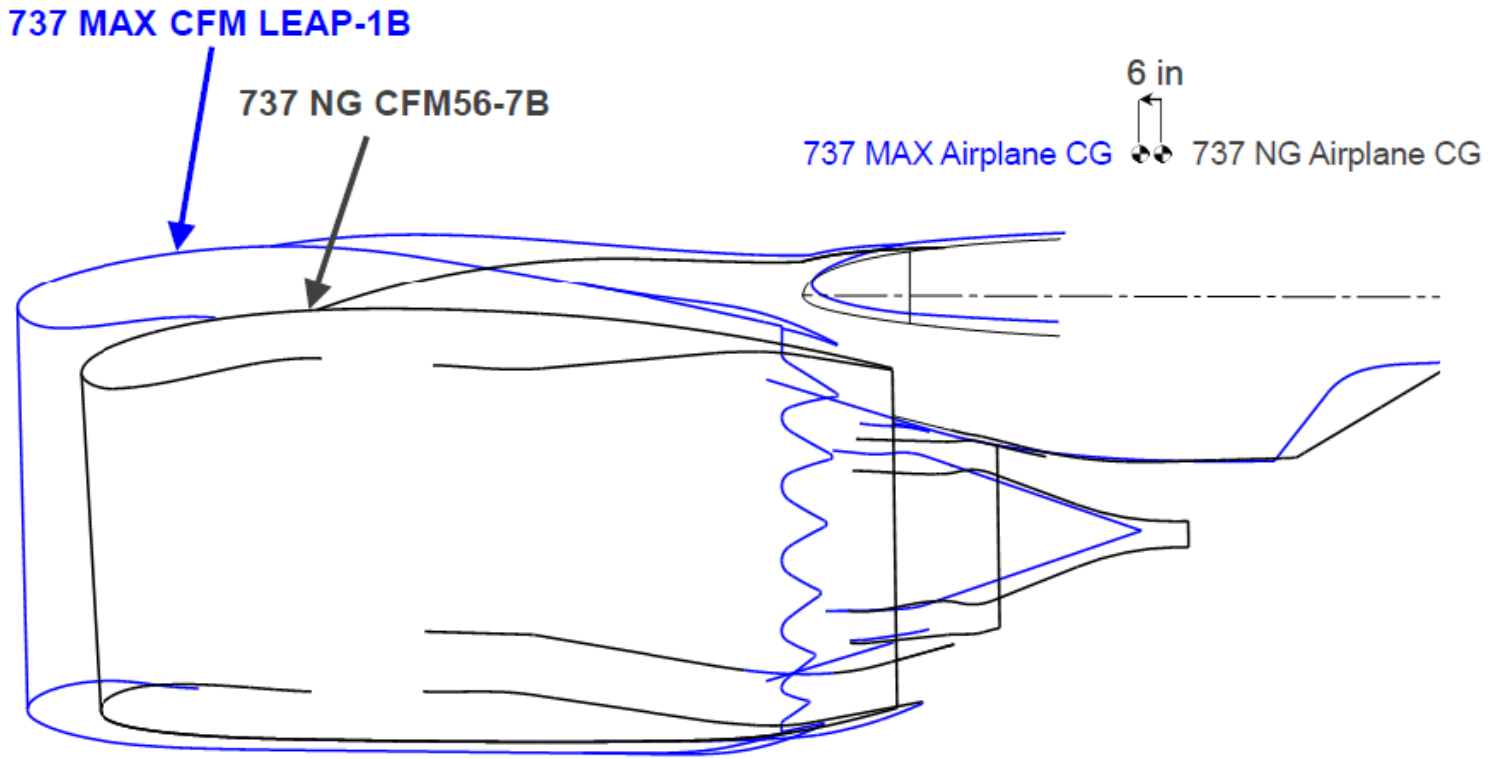
- MCAS redesign has several added safety features – any one would have prevented accidents

- System Safety Assessment concludes MAX both meets certification requirements and is safe

Outline

- Why an MCAS
- Principal MCAS enhancements and why
- System safety analysis process

Why an MCAS?


737 MAX CFM LEAP-1B
737 NG CFM56-7B
6 in
737 MAX Airplane CG
737 NG Airplane CG

Why an MCAS?

- Part 25.203(a) “Stall Characteristics”
  - …The longitudinal control force must be positive up to and throughout the stall…
- At high AOAs, MCAS trims the stabilizer nose down, which maintains a positive longitudinal control force up to and throughout the stall

Principal MCAS enhancements and why

- Elevator can counter MCAS stabilizer command
  - Software limits how much MCAS can move stabilizer away from the trim position, so as to guarantee elevator can overpower MCAS input
- One MCAS command per high-AOA event
  - AOA has to go to low values before MCAS will activate again
  - Pilot electric trim use does not reset MCAS
- AOA sensors compared and signals enhanced
  - Both vanes monitored
  - Smart algorithm added

- Any one of these enhancements substantially reduces MCAS risk

System Safety Analysis Process

- Complete system description
- Complete Speed Trim System control law description
  - Speed Trim Function
  - MCAS Function
- Functional Hazard Assessment
- Failure Modes and Effects Analysis – a bottom-up assessment
- Fault Tree Analysis – a top-down assessment
- Common Cause Analysis – determines system independence reqs.
- Single and Multiple Failure Analysis
- Development Assurance
- Compliance Summary

Conclusions

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