Docket No. SA-533

Exhibit No. 13E

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C.

ATR Presentation – ATR Flap and Stall Warning Systems

(15 Pages)

ATR 42 – Flap and stall warning systems

CONTENT

FLAP SYSTEM

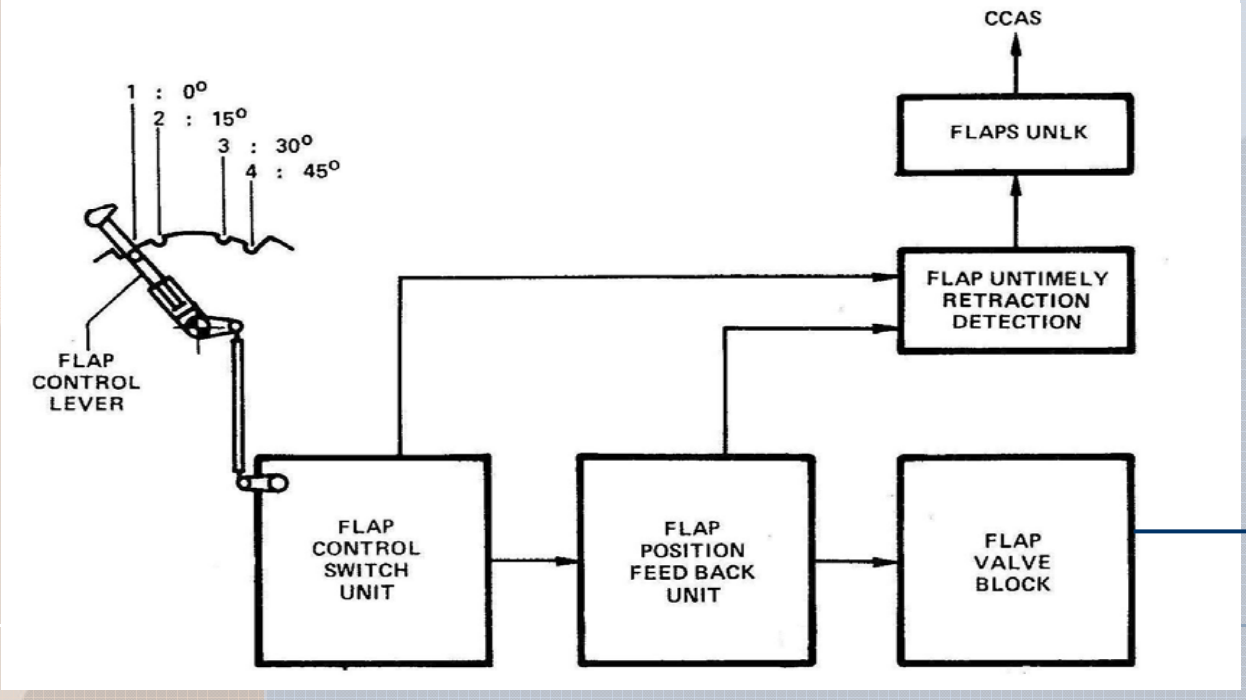
- Electrical command
- Hydraulic actuation
- Indications
- Asymmetry detection
- Performance
- Asymmetry certification

STALL WARNING SYSTEM

- Operation

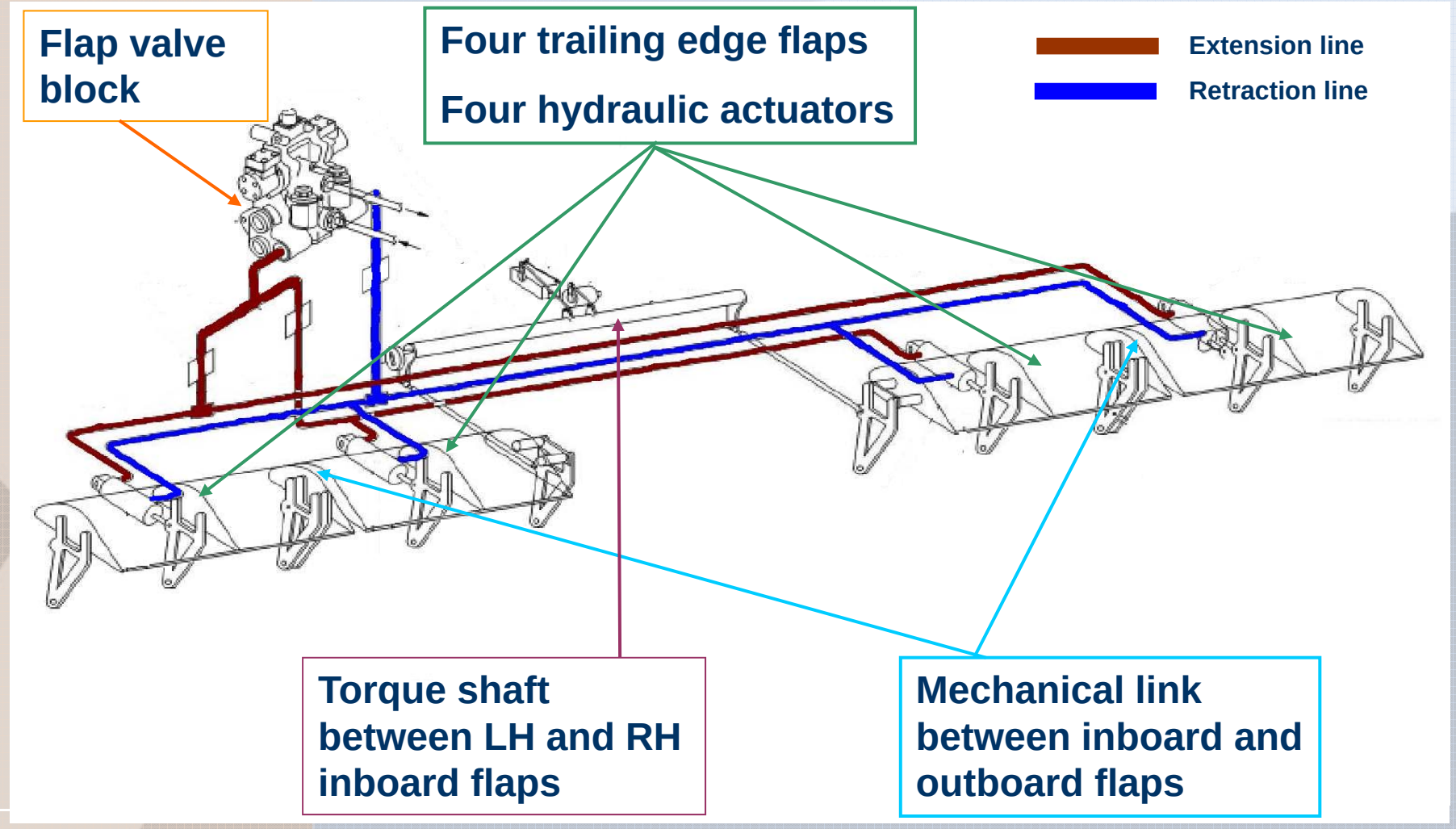
FLAP SYSTEM – Electrical command

- Flap position is mechanically selected through control lever
- Extension and retraction commands performed through microswitch units.



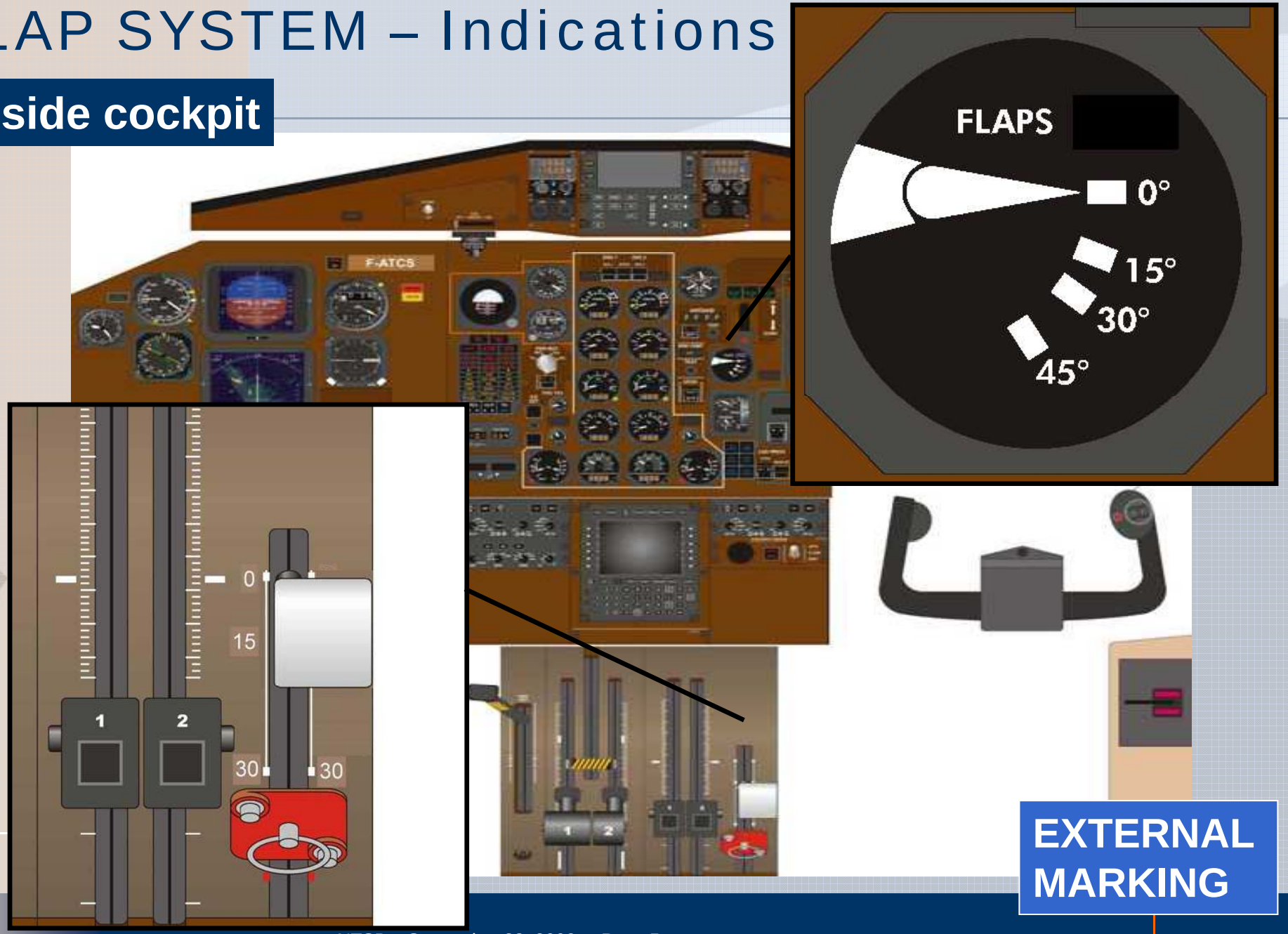
Pressure supplied to flap actuators

FLAP SYSTEM – Hydraulic actuation



FLAP SYSTEM – Indications

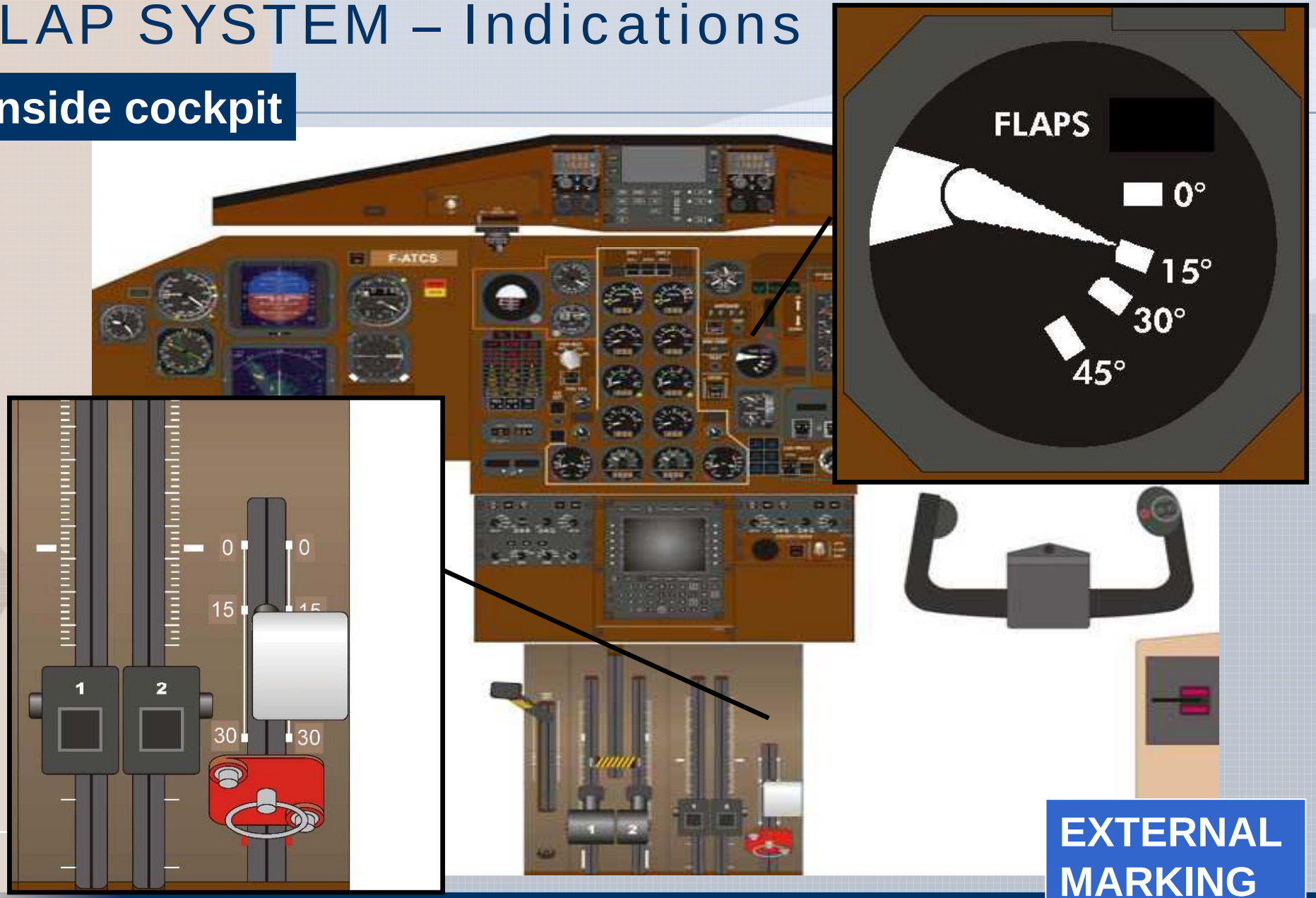
Inside cockpit



EXTERNAL MARKING

FLAP SYSTEM – Indications

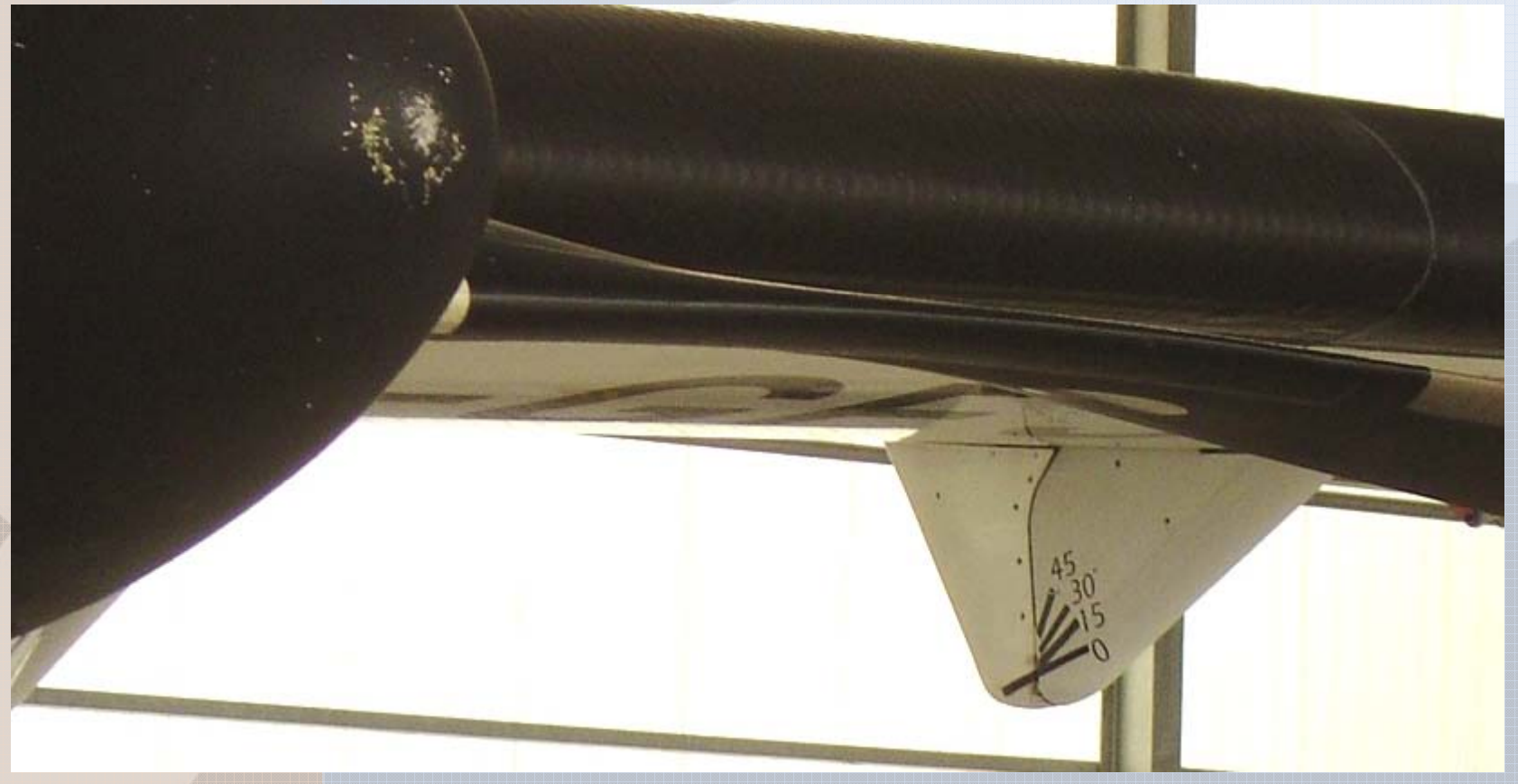
Inside cockpit



EXTERNAL MARKING

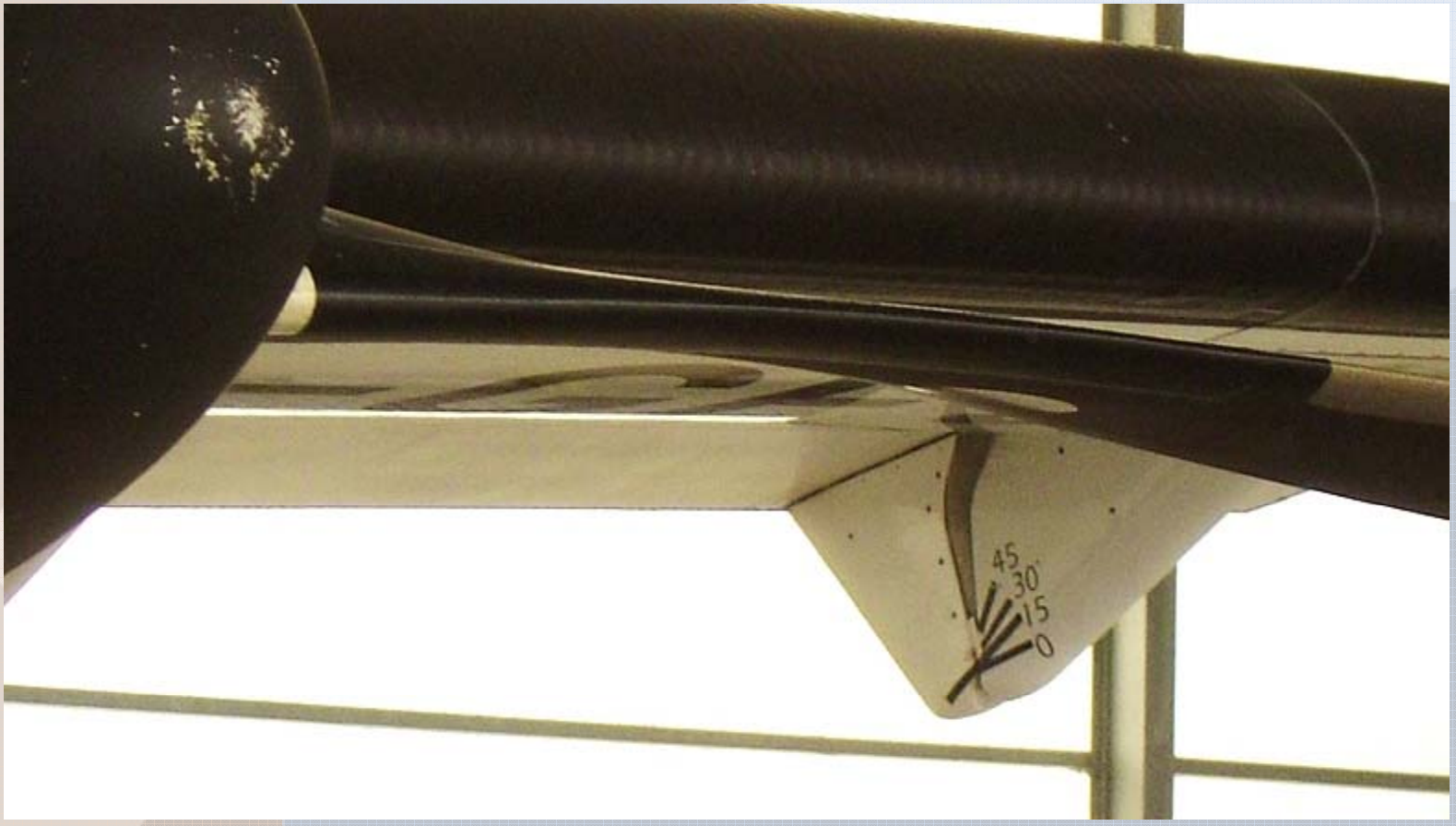
FLAP SYSTEM – Indications

As seen from the cockpit



FLAP SYSTEM – Indications

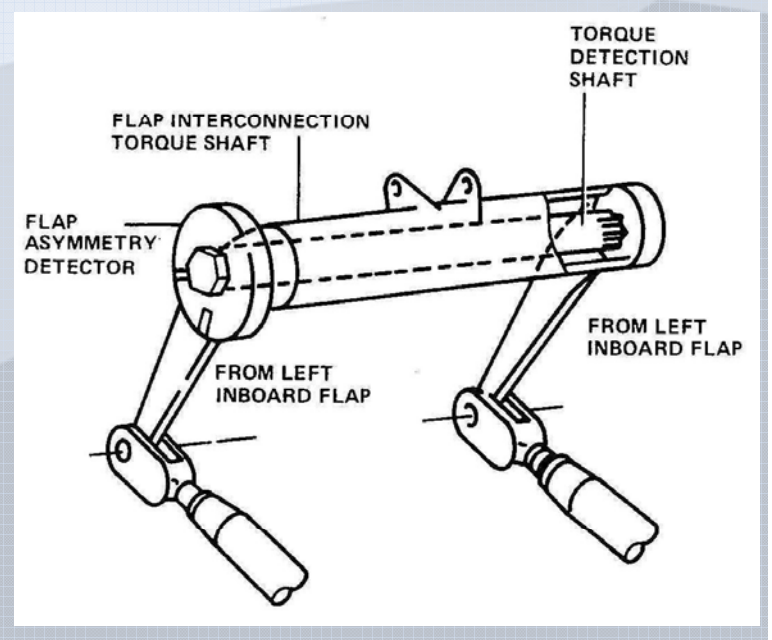
As seen from the cockpit



FLAP SYSTEM – Asymmetry detection

- Two torque tubes connected together on RH side. External tube connected to LH inner flap while internal tube ends on asymmetry detector unit.

- Flap asymmetry protection activates for an asymmetry between 8 and 10°
  - Command is inhibited.
  - Flaps are hydraulically locked.
  - Flap indicator shows average position between LH and RH flaps.



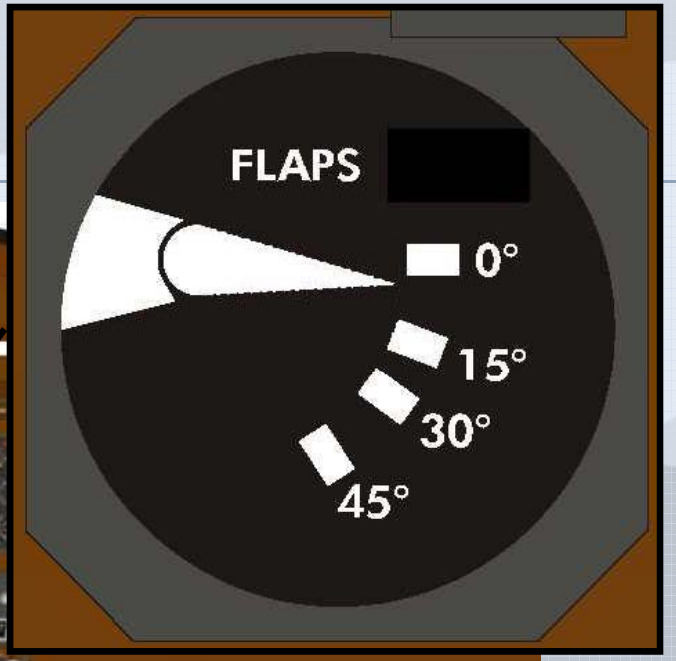
FLAP SYSTEM – Performance

- Operational loads at level of one flap actuator (actuator specification)
  - Flaps 0° 40 DaN / 90 lbf (traction)
  - Flaps 15° 523 DaN / 1175 lbf (compression)
  - Flaps 30° 1031 DaN / 2317 lbf (compression)
  - Flaps 45° 1852 DaN / 4153 lbf (compression)
- Maximum extension load, generated by one flap actuator, under a pressure of 205 bar :
  2309 DaN / 5190 lbf

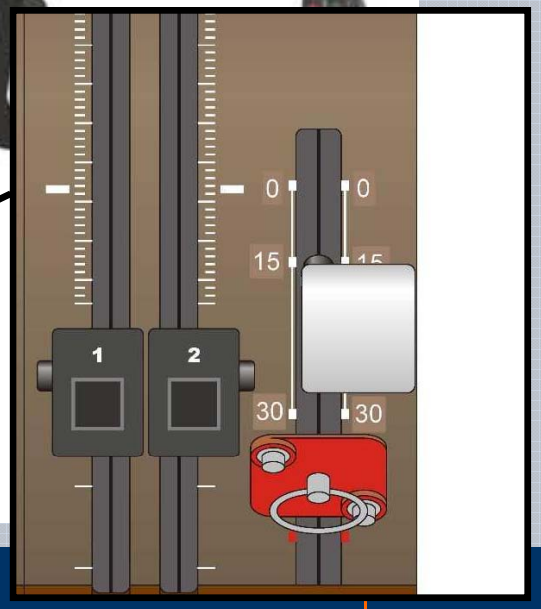
FLAP SYSTEM – Asymmetry certification

- The flap system is designed to limit the flap asymmetry (8 to 10°), to prevent an unsafe condition to develop.
- Simulation (wind tunnel tests) and analysis, performed for certification most critical cases (take off and landing), show that a 10 ° flap asymmetry configuration can be handled even in adverse lateral wind conditions (more than 25 Kts).
- Airworthiness Authorities agree : no unsafe flight condition exists with 10° flap asymmetry. Aircraft handling characteristics within certification criteria. Specific flap asymmetry indicator is not necessary.

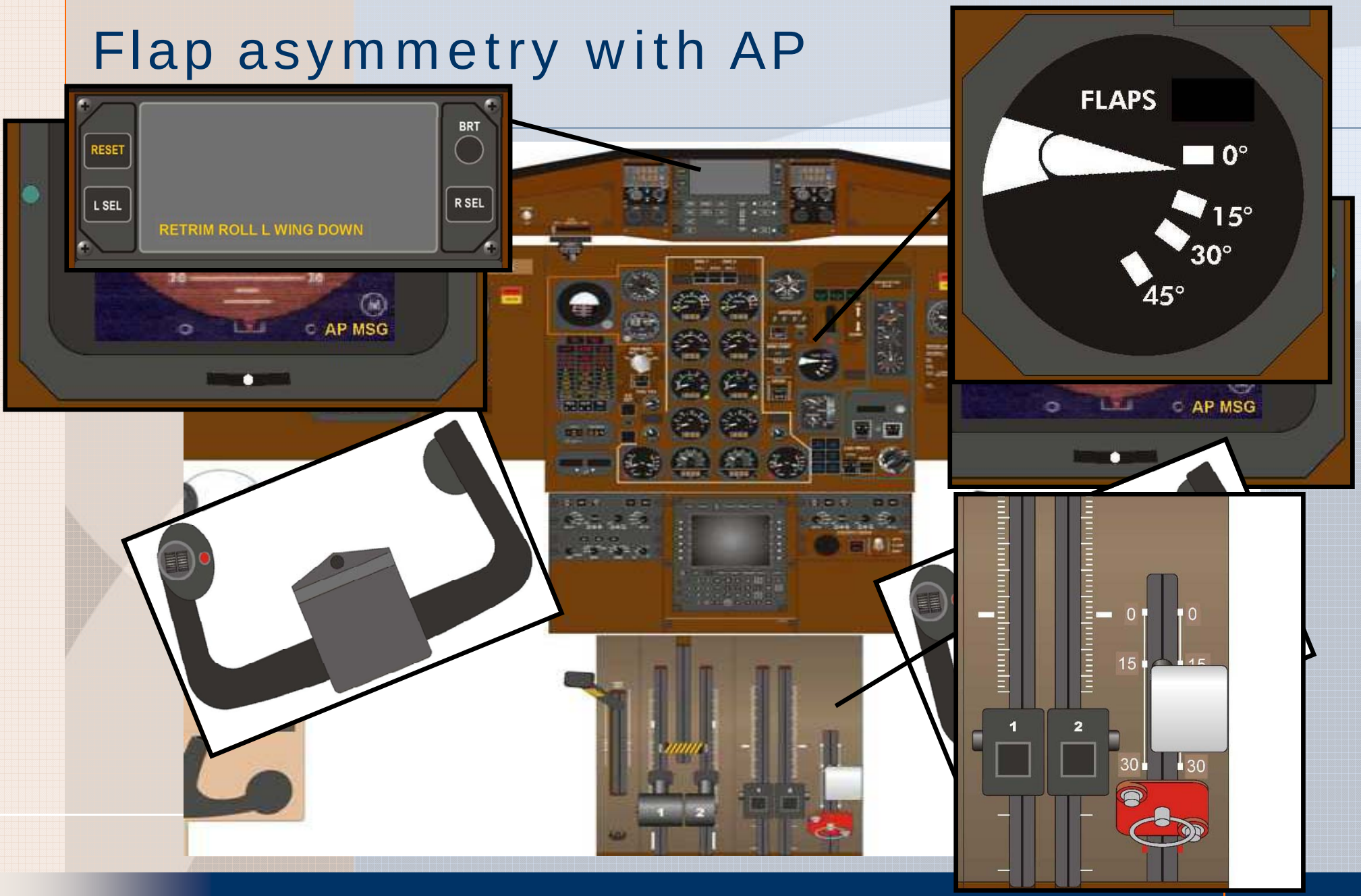
Flap asymmetry



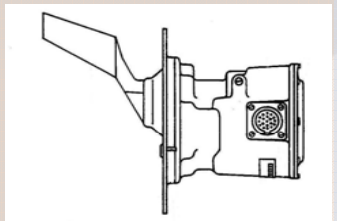
Aircraft rolling moment



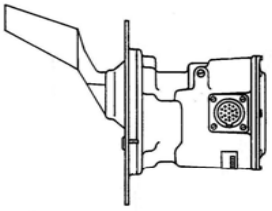
Flap asymmetry with AP



STALL PROTECTION SYSTEM - Operation



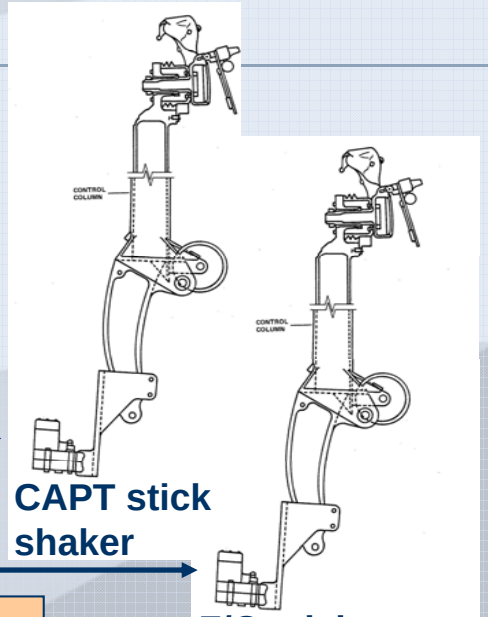
RH AOA probe



LH AOA probe

Crew Alerting Computer

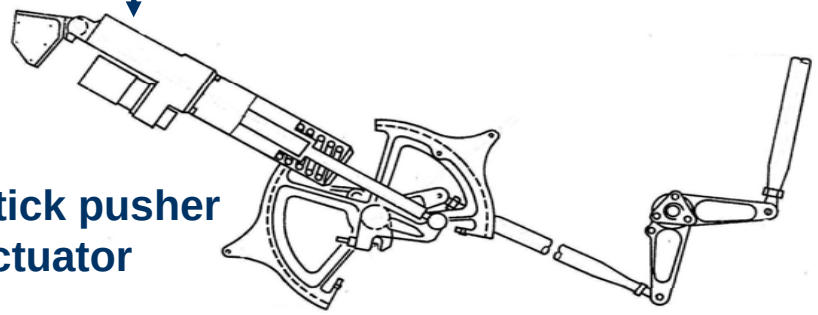
Cricket



CAPT stick shaker

F/O stick shaker

A/P



Stick pusher actuator

STALL PROTECTION SYSTEM - Operation cont'd

- Stick shaker + cricket thresholds depend on :
  - icing conditions (activated through horn anti-icing selection) non icing : 18.1° / icing : 11°
  - take off condition
- Cricket has the highest priority among aural alerts
- Stall warning activation disengages autopilot
- Stick pusher thresholds depend on :
  - Flap achieved position
  - Angle of attack variation