E230 Aircraft Systems

Fly fast Fly slow

6th Presentation

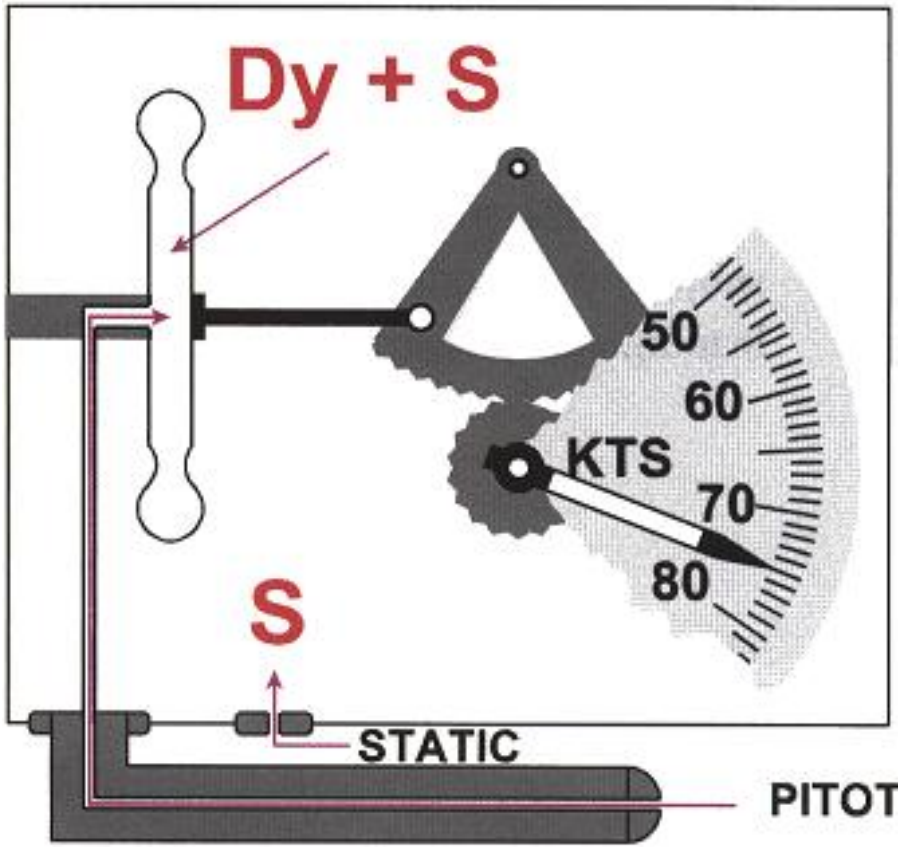
School Of Engineering

Air Speed Indicator

- Airspeed indicator (ASI) is an instrument that measures speed relative to surrounding air.
- The faster the aircraft the greater the dynamic air pressure.
- ASI uses the difference in pitot and static pressure for measurement.
- Compensation for variation in position, compression, density is necessary for true airspeed.
- Shows indicated airspeed if uncorrected.

Operation of ASI

- Dy = Dynamic Pressure
- S = Static Pressure
- When aircraft is stationary, Dy = 0
- As pitot pressure increase, capsule expands to increase reading



Markings on a ASI

V_{S0}

V_{S1}

V_{NE}

V_{FE}

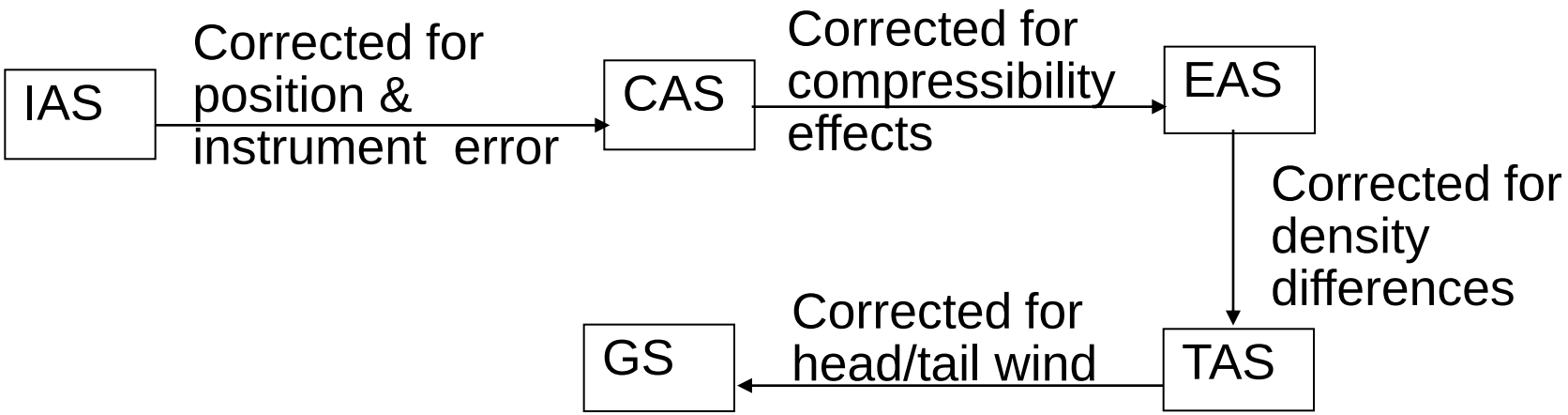
V_{N0}

- White range: operating speed with flaps extended
- Green range: operating speed with flaps retracted
- Yellow range: May be operated in smooth air condition

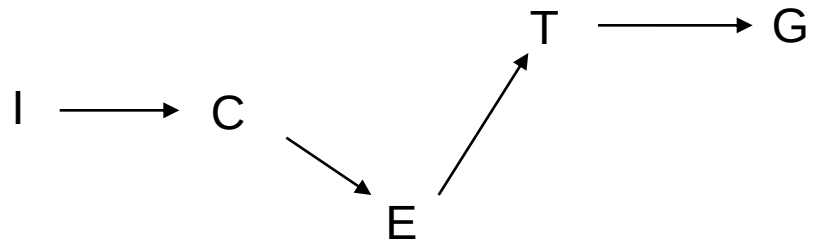
Markings on a ASI

- V_{S0} – Stall speed with flaps/landing gear fully extended
- V_{S1} – Stall speed with flaps/landing gear retracted
- V_{FE} – Maximum speed with flaps/landing gear fully extended
- V_{N0} – Maximum speed with flaps/landing gear retracted
- V_{NE} – “Never Exceed” speed, beyond which structural damage may occur

Airspeed conversion



- Memory aid: ICE-TG



Mach Number

- Mach number = True Airspeed/Speed of sound
- Speed of sound varies with temperature
- Temperature varies with altitude
- Thus Mach number varies with altitude
- The same airspeed can have different Mach numbers depending on the flight altitude

Machmeter

- Knowing the airspeed alone is not enough to avoid shock waves forming at the critical Mach number
- Pilot needs to know the Mach number and not the airspeed to avoid shock waves
- That is why machmeter is needed.

Mach/Airspeed Indicator (MASI)

- The “barber pole is the maximum speed pointer or M_{MO}/V_{MO} pointer
- Barber pole shows limit of M_{MO} at high altitude
- Barber pole shows limit of V_{MO} at low altitude
- Pointer decreases with increasing altitude as speed of sound decreases
- $M_{MO:}$ Max speed to avoid shockwaves
- $V_{MO:}$ Max speed to avoid structural damage

Overspeed Clacker

- If M_{MO} or V_{MO} exceeds the limit , an aural warning known as a “clacker” will be heard.

Overspeeding on Boeing 747

Learning objectives

- Discuss operation principle of ASI and machmeter
- Express conversion of indicated airspeed to ground speed
- Describe the colour bands on the ASI
- Explain how mach number can vary for the same airspeed