

1st Asia Pacific Workshop on Flying at High Altitude under Adverse Weather Conditions



Flight at High Altitude in Adverse Conditions Flight Aspects

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Organisers



Supporting Partners





Overview

- Basic Aerodynamics Recall
- Performance
- Handling Qualities
- Human Factors
- Discussion Points



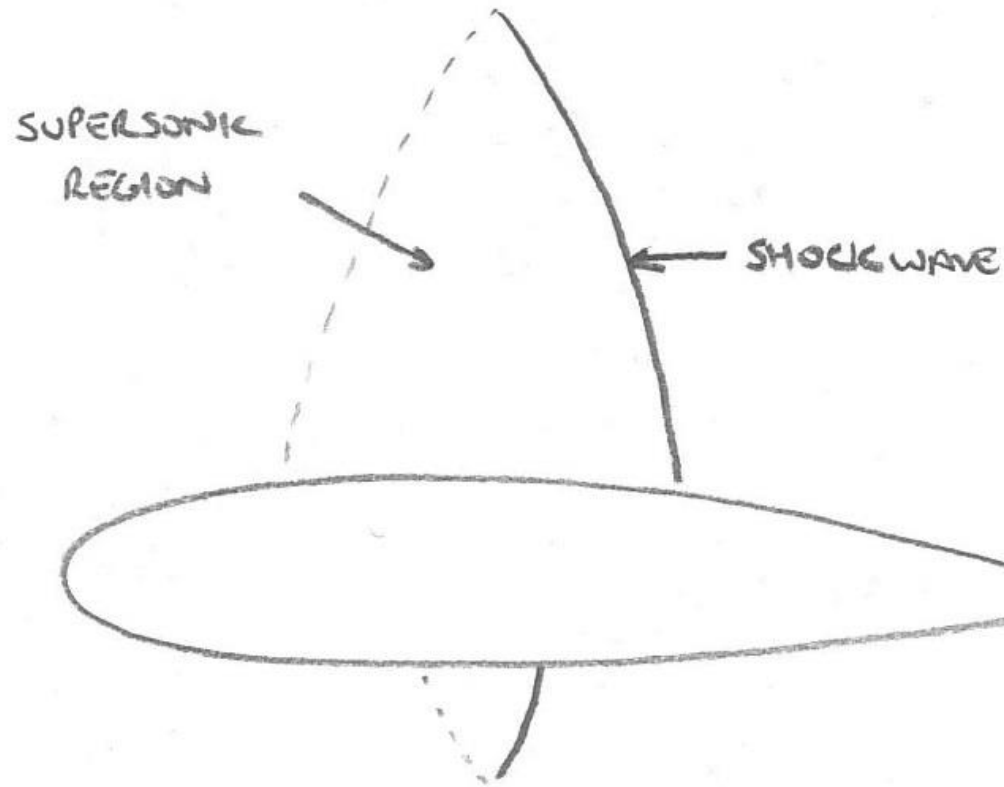
Manual Flying





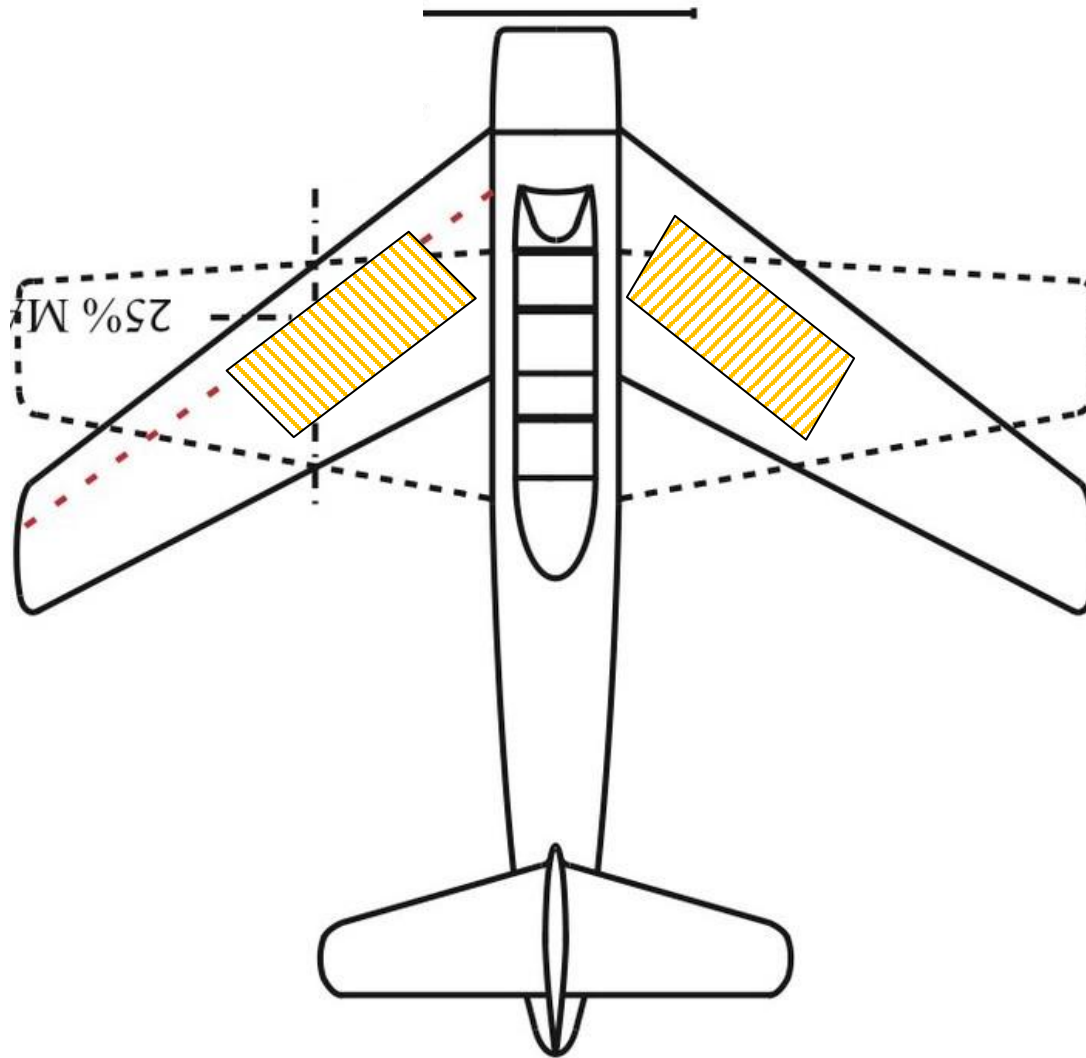
Basic Aerodynamics Recall

- High Altitude = Reduced ρ
- $IAS \propto \frac{1}{2} \rho_0 TAS^2$
- High Altitude = Reduced T = Increased Mach
- Main Effects on Performance & HQ:
 - Restricted operating speed (Mach) range
 - Reduced thrust
 - Reduced manoeuvre margin
 - Reduced dynamic stability
 - Reduced aerodynamic damping





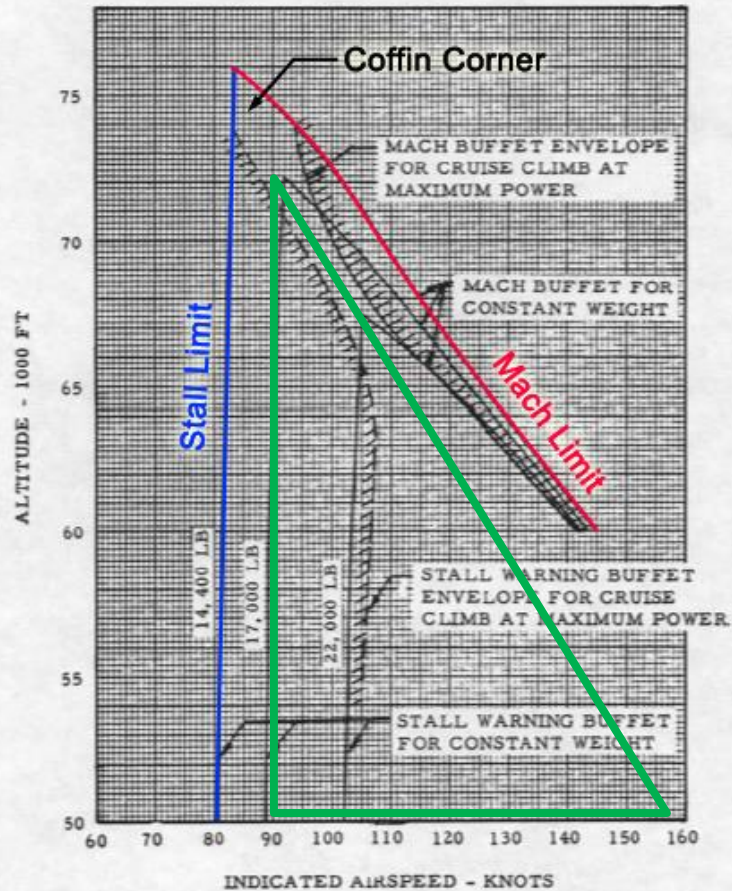
Performance





Performance

STALL AND MACH BUFFET BOUNDARIES





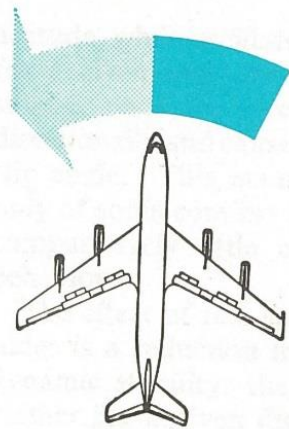
Performance

Note: As ISA Temp increases – Altitude capability is reduced.

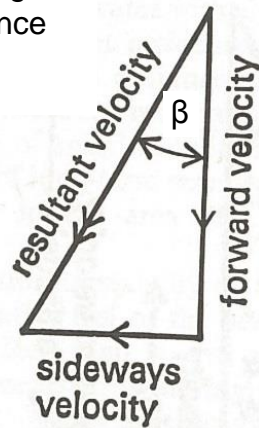




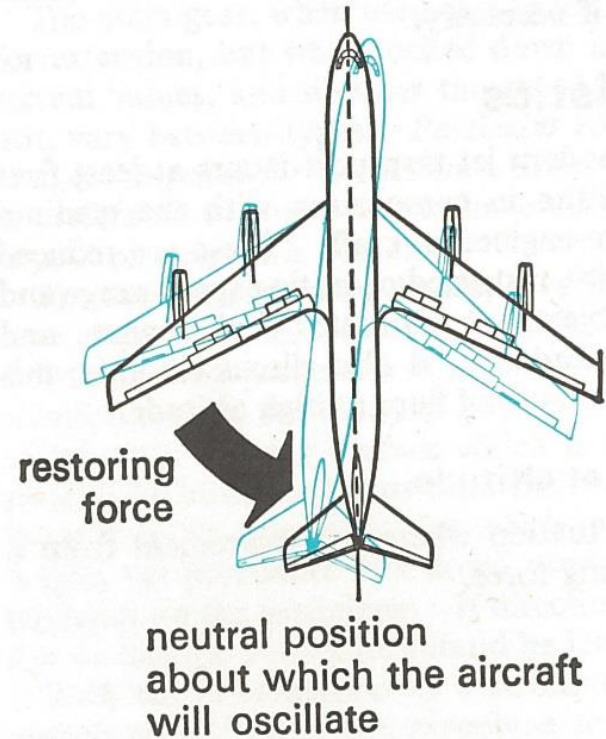
Handling Qualities



β = fin angle
of incidence

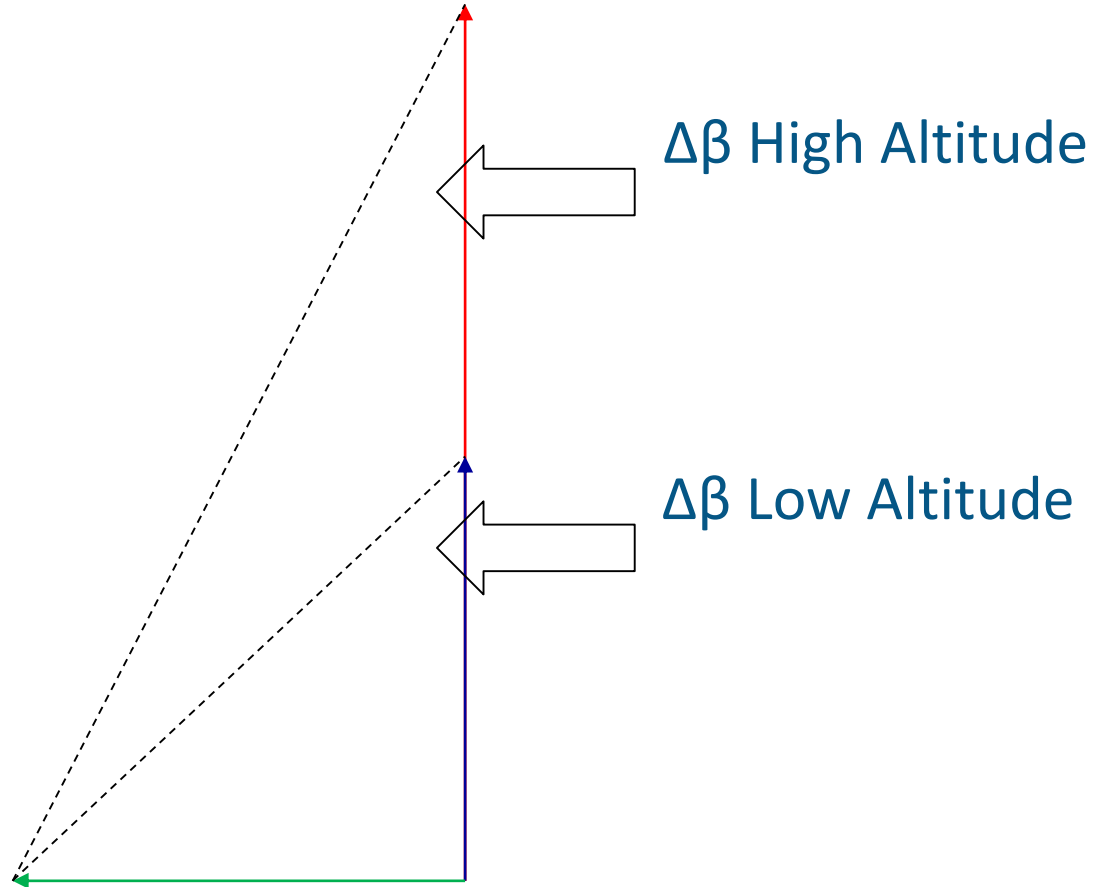


And
thus:



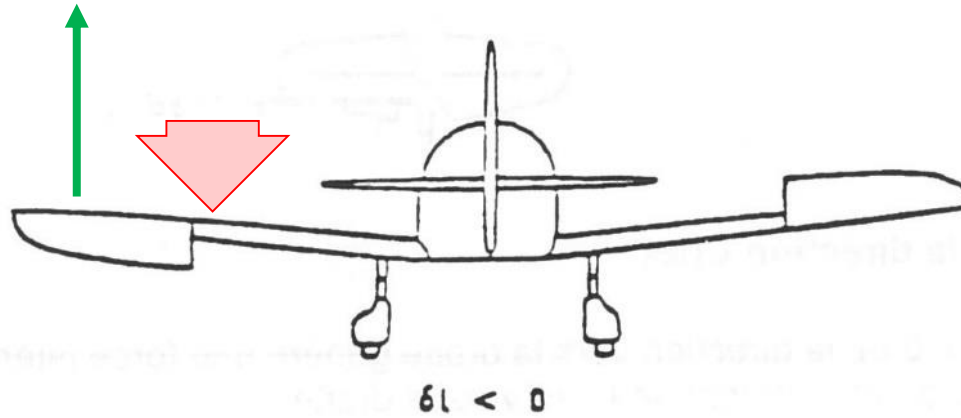


Handling Qualities





Handling Qualities





Handling Qualities

Low Altitude:

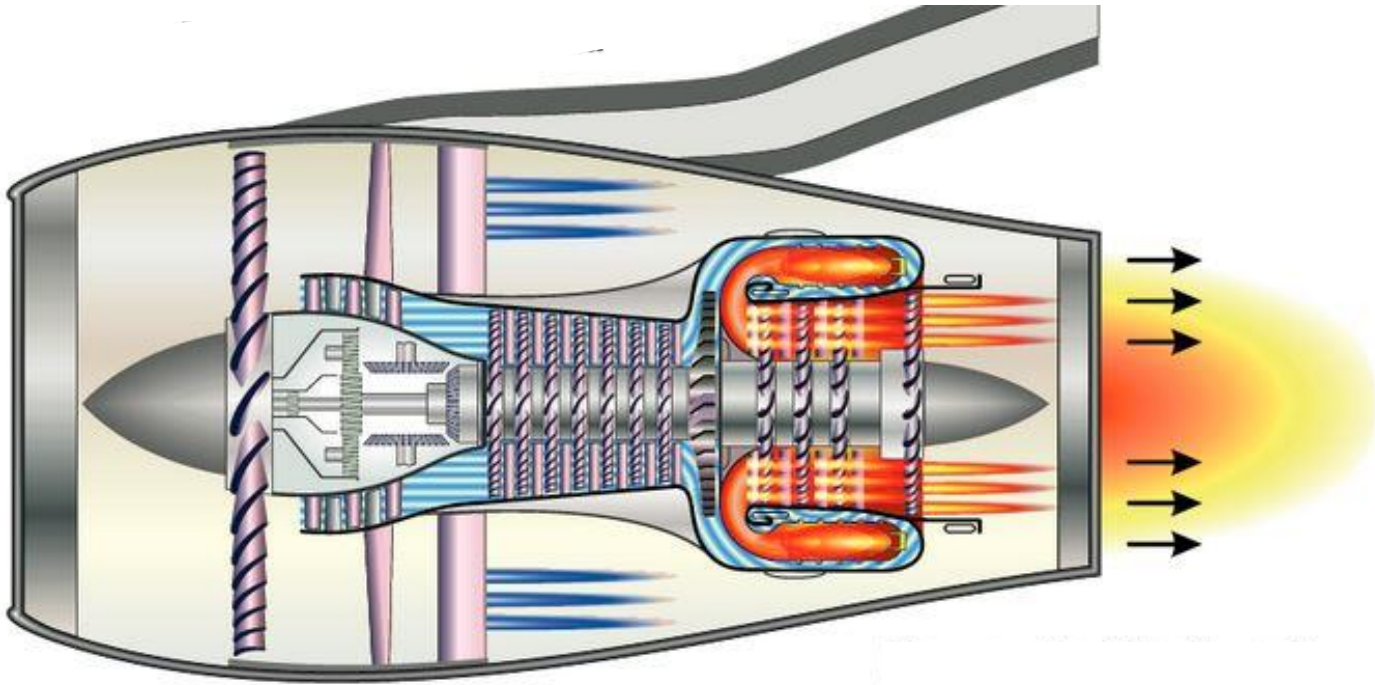
- Aircraft feels 'normal'.

High Altitude:

- Aircraft feels sensitive
- **Very easy for pilot to over-control.**



Handling Qualities- Thrust



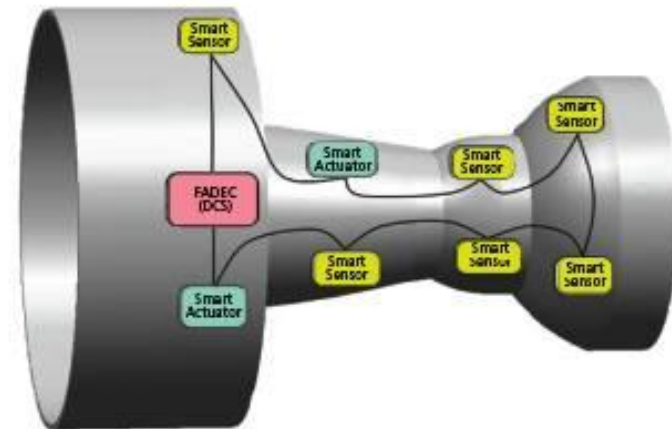
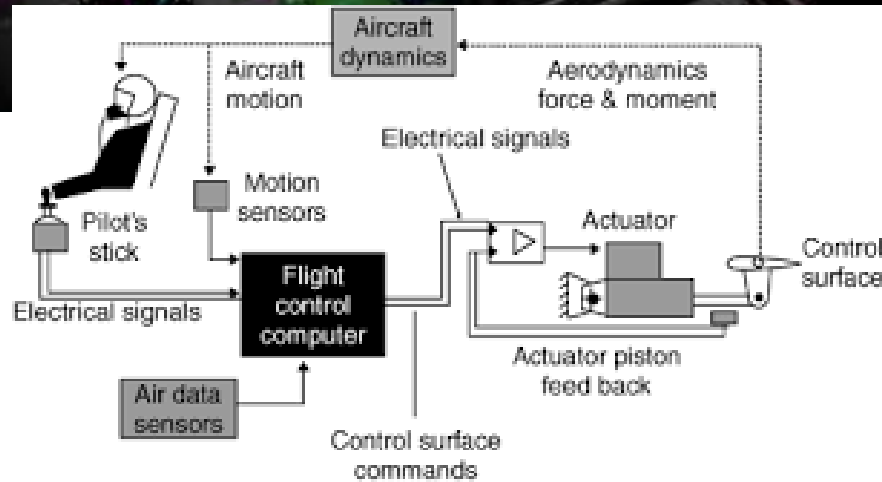


Human Factors





Human Factors





Aviation in itself is not inherently dangerous.

But to an even greater degree than the sea, it is terribly unforgiving of any carelessness, incapacity or neglect.

— *Captain A. G. Lamplugh, British Aviation Insurance Group, London. Circa early 1930's*



Discussion Points

- Pilots retain own professional knowledge of aerodynamics?
- Incorporate surprise elements to simulator training to expose pilots to startle effect?
- Ensure simulators representative of the real aircraft for flight at high altitude and high/low Mach outside operational envelope?
- Does the Industry support Manual Flying? (no)



EASA
European Aviation Safety Agency

Discussion/Questions?

Your safety is our mission.

An agency of the European Union

