

Stalling

20160104

Learning Outcomes

1. Explain the relevance of the Critical Angle of Attack.
2. Explain the effects of the following factors:
 - a. Weight variations
 - b. Power variations
 - c. Flap extension
3. Recall from memory the airborne HASELL checks.
4. Recall indications of slow speed flight.
5. From memory, list the actions that must be taken by the pilot in the event of a stall.
6. Demonstrate an awareness and eagerness to identify possible threats to the safe outcome of the flight.

Stalling

- In the lift formula, $L = C_l * 0.5 * \rho * V^2 * S$, the stalling component is $0.5 * \rho * V^2$.
- A stall is induced by exceeding the Critical Angle of Attack.
- Since there is no instrument to measure AoA, manufacturers provide a stall speed (V_s).
- V_s assumes the aircraft is configured:
 - Maximum Take Off Weight (MTOW)
 - Idle Power
 - Load Factor = 1
 - Zero Flap
 - Most Forward CoG
- Sometimes V_{s1} is given. Stall speed in landing configuration:

- Full flap
- Gear down

Airspeed Indicator

- Bottom of green arc ~ stall speed with no flap.
- Bottom of white arc ~ stall speed with flap.

Factors affecting stall speed

- Reduction in weight.
- Load Factor change.
- Effect of Power.
- Effect of Flap.
- Use of aileron.

Calculating new stall speed

- New Stall Speed = Old Stall Speed * (Load Factor ^{0.5})
- 60 degree AoB ~ 2g
- Therefore, 45 degree AoB ~ 1.41g
- Example question

An aircraft with flying stall speed of 62KIAS performs a 60 degree turn.
What is the new stall speed?

Wingdrop

- Do not use aileron in a stall, approximately < 60KIAS until airspeed recovers.
- Causes wingdrop and possible spin.

Summary of Factors

Factor	Variation	Result on Stall Speed
Weight	increase	increase
Weight	decrease	decrease
Load Factor	increase	increase
Power	increase	decrease
Flap	extension	decrease
Leading Edge Ice	wing shape change	increase
Bird Strike	wing damage	increase
Hoar Frost	boundary layer	increase

HASELL Checks

- Height: Must recover by 3000AGL
- Airframe: Configured (flap up)
- Security: No loose objects, hatches and harness secure
- Engine: Pressures and temps checked
- Location: Not over built-up areas
- Lookout: 360 degree clearing turn before commencing and 90 degree between each stall

Impending stall

Indicators

- Slow and decaying airspeed
- Nose-high attitude
- Less wind noise
- Controls less responsive
- Stall warning (5-8KIAS above Critical AoA)
- Control buffet

Recover Lower nose if warnings of impending stall

Developed stall

Indicators

- loss of height (*guaranteed*)
- nose drop (*maybe*)
- wing drop (*maybe*)

Recover

- Lower nose to level
- Add full power
- Right rudder
- After sufficient airspeed, raise nose slightly

Common Faults

- Lowering nose too far (do not exceed loss of > 100ft altitude)
- Delayed application of full power
- Pull up too quickly after recovery -> secondary stall

Inducing stall

- at lower power setting, carb heat
- at stall warning, carb heat off

Remember

- HASELL check
- Symptoms of impending stall
- Symptoms of developed stall
- Recovery of impending stall
- Recovery of developed stall