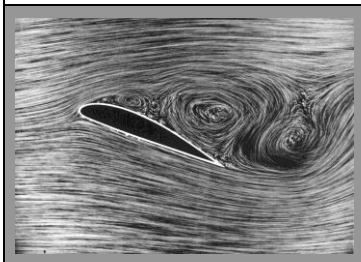
Stall Overview

AIR ECHO ALPHA 51, LLC.

Objective: Promote the recognition of operational and environmental conditions that increase the likelihood of a stall, knowledge of stall fundamentals and types of stalls, understanding of stall characteristics and the application of stall recovery procedures.



Types of Stalls

- ❑ **Imminent Stall:** Approaching a stall but does not reach the critical AOA & full stall
- ❑ **Power–Off Stall (Approach):** Established in the landing or descent configuration
- ❑ **Power-On Stall (Take-off):** Established in the takeoff or climb configuration
- ❑ **Secondary Stall:** Occurs after a rushed recovery from a preceding stall
- ❑ **Accelerated Stall:** Encountered at a higher indicated airspeed due to maneuvering loads
- ❑ **Cross Controlled Stall:** Occurs with the controls crossed, aileron pressure applied in one direction and rudder pressure in the opposite direction.
- ❑ **Elevator Trim Stall:** Strong trim forces resulting in a stall

Dissecting the Stall — 10- Min

- ❑ A stall occurs when the airflow over the airplane's wing is disrupted & separates from the upper surface of the wing
- ❑ Angle of Attack (AOA) is the angle at which the chord of an aircraft's wing meets the relative wind.
- ❑ The direct cause of **every** stall is an excessive **AOA** (typically between 16° to 20° depending wing design)
- ❑ The critical AOA can be exceeded at low or high power settings & in turning flight

Phases of Flight — 15- Min

- ❑ Slow flight is a part of NORMAL flight operations, and includes the speeds a pilot might use in the take-off, approach and landing sequence.
- ❑ Flight between the stall warning horn and the actual stall (up to the critical Angle of Attack) moves into ABNORMAL flight operations. Part of stall prevention training is to respond to the stall warning horn and return to normal flight.
- ❑ An unintentional stall constitutes an EMERGENCY.

Recognizing the Stall (All of the following have limitations) — 15- Min

- ❑ Vision
  - Aircraft Attitude
- ❑ Hearing
  - Change in sound due to loss of RPM & airflow along the aircraft structure
- ❑ Kinesthesia (sensing changes in direction or speed of motion)
- ❑ Control pressures
  - Greater displacement of the controls are needed to achieve desired results
  - Buffeting or vibrations
- ❑ Stall warning device
  - Horn, light, or buzzer
- ❑ Airspeed indicator

Stalling Speed — 15- Min

- ❑ The stalling speed of a particular airplane is **NOT** a fixed value!
- ❑ Factors that can alter the stalling speed
  - **Weight:**
    - Weight & Balance aircraft loading
    - Load Factor (G's)
      - Increases in turns, abrupt pull-ups, dives, and aerobatics
      - Increased G's due to weather turbulence, wind-shear, etc..
    - Density:
      - Function of pressure & temperature
    - Wing Surface Area:
      - Flaps
    - Coefficient of Lift:
      - Wing design, flaps (the effectiveness of the airfoil to produce lift)
    - CG location:
      - Weight & Balance aircraft loading
    - Snow, ice or frost on the wing surfaces
- ❑ How these factors influence the stall speed
  - W Increases = Stall speed increase
  - G's Increase = Stall speed increase
  - p(rho) Increases = Stall speed decreases
  - S Increases = Stall speed decreases
  - C_L Increases = Stall speed decreases
  - Forward CG = Stall speed increases
  - Snow, Ice or Frost = Stall speed increases

The Math behind the Madness

* The Lift Equation $L = \frac{1}{2} \rho V^2 S C_L$
p(rho) = density, V = Velocity,
S = Surface Area, C_L = Coefficient of Lift

* In un-accelerated steady flight L = Weight
substitute W for L and Solve for Velocity
V = Square root of $\frac{2W}{\rho S C_L}$

*True stall speed
V = Square root of $\frac{2W}{\rho_{SL} S C_L} * \frac{\rho_{SL}}{\rho}$

Stall Recovery — 5- Min

- ❑ The first and most important correction to make at the initial indication of a stall, is to reduce the **Angle of Attack**!!!!