Exercise 12 - Stalls

What you will learn:

- ✓ To recognize symptoms of approach of a stall and the stall itself
- ✓ To recover from various types of stalls
- ✓ First priority,recovery. Second, Altitude

Why learn this:

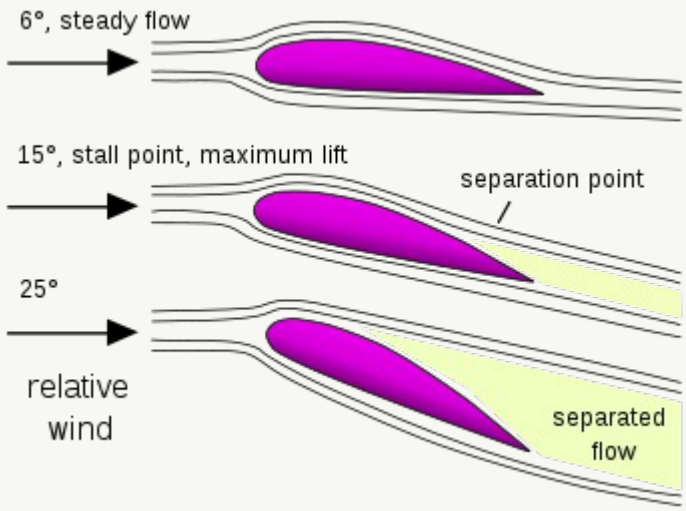
- ✓ 1) To AVOID getting into a stall
- ✓ 2) To RECOVER from an inadvertent stall if one does occur.

What is a Stall?

- ✓ - loss of Lift and Increase in drag when an aircraft is flown at an angle of attack (AoA) greater than the angle of maximum lift.
- ✓ Smooth airflow over wing goes turbulent

What is a STALL?

It is a Loss of Lift…due to separated airflow

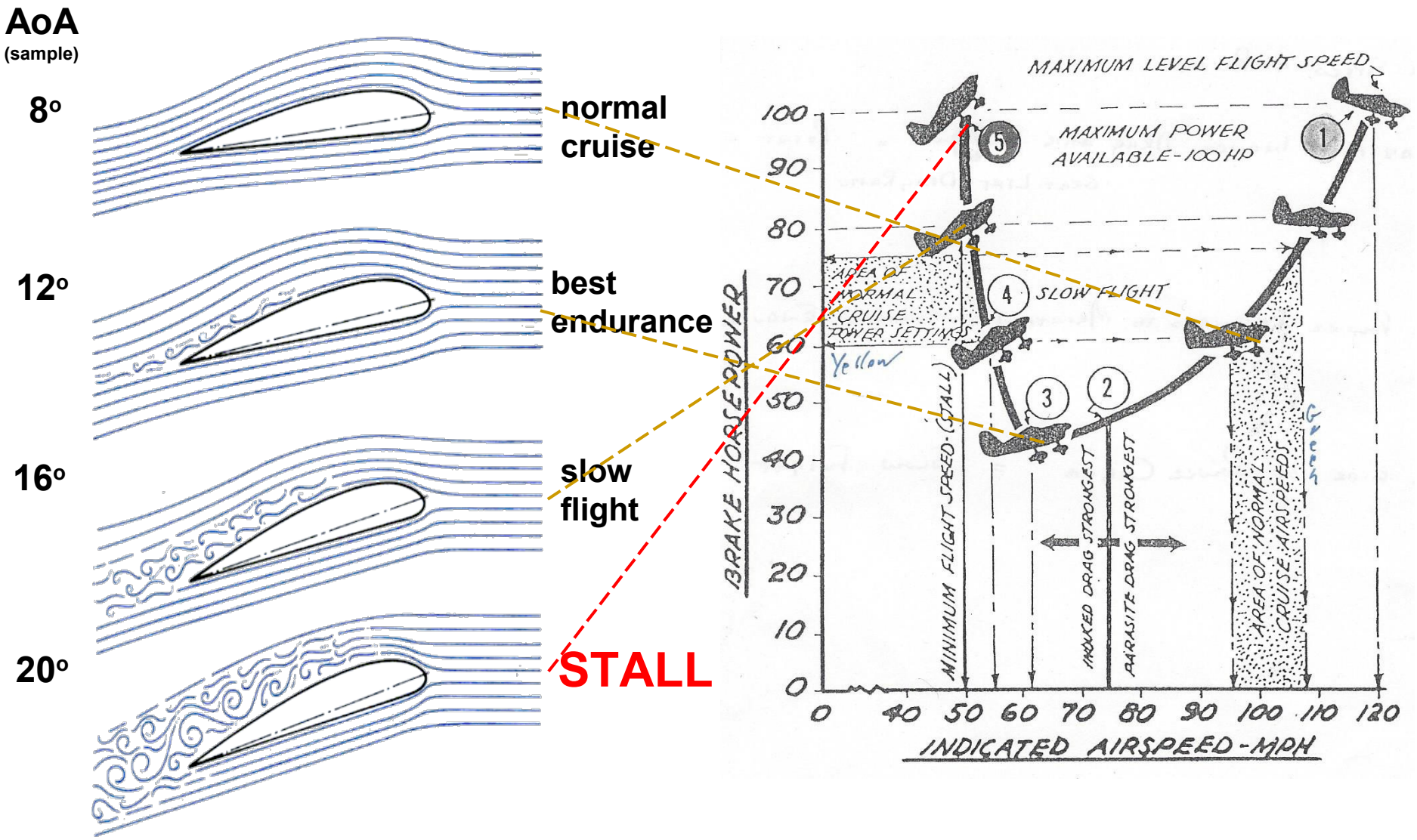


Theories and Definitions:

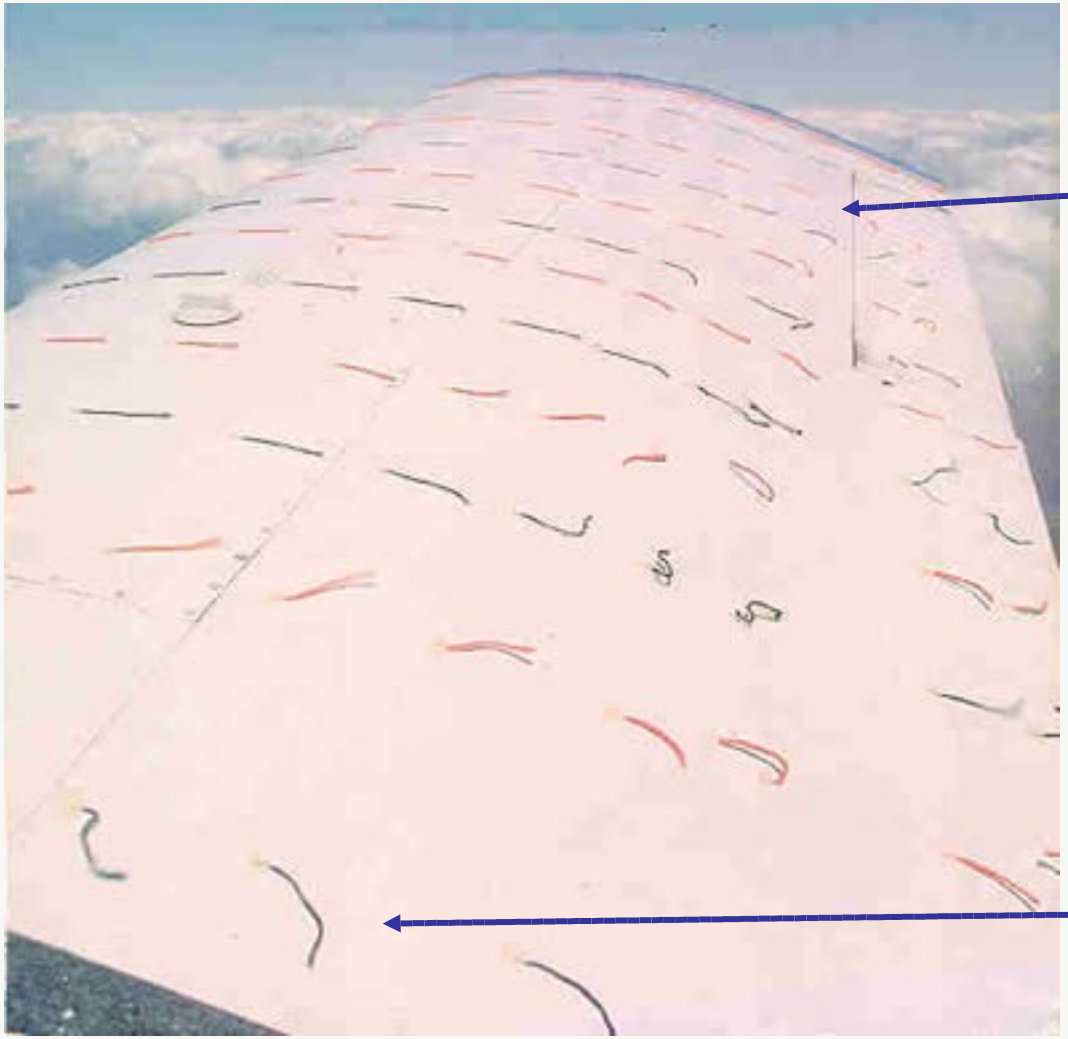
- ✓ How Does a Wing Stall?
- ✓ Symptoms of an Approaching Stall
  - Controls
  - Buffet

- ✓ Just like best range and best endurance flight, stall always occurs at the same **ANGLE OF ATTACK**
- ✓ And just as with best range and best endurance, we talk about stall **SPEED**

How a Wing Stalls:



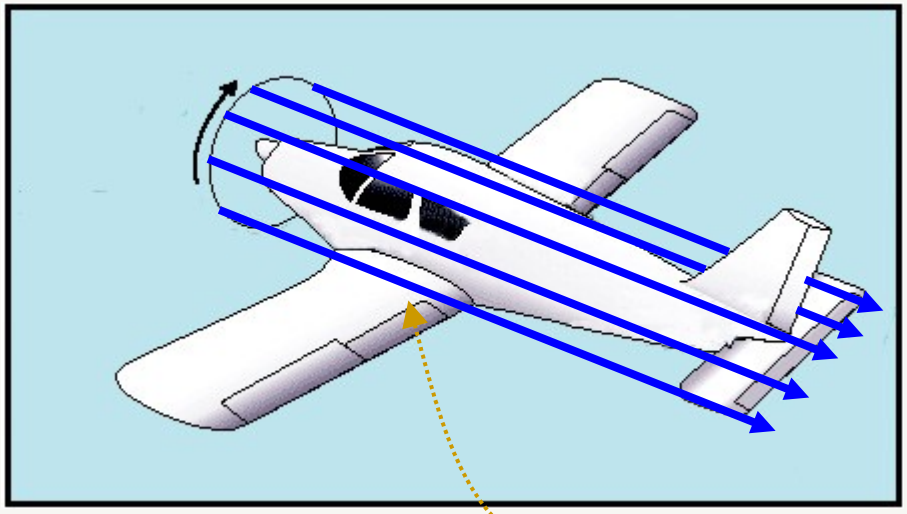
Stall Approach: Controls



Washout: wing twisted so root stalls first-ailerons still work for control

Stall Approach: Controls

POWER-ON STALL



Wing tips may stall before wing roots

- **Ailerons will be less effective just before and in a power-on stall**
- **Wing drop may result.**

Propeller slipstream flows over wing roots, helping delay their stall and canceling the effect created by washout

Stall Approach Symptoms

- Sloppy Controls
- Stall horn
- Buffeting (shaking)
- Loss of Altitude

Attitude is not sufficient to determine whether a plane is about to stall.

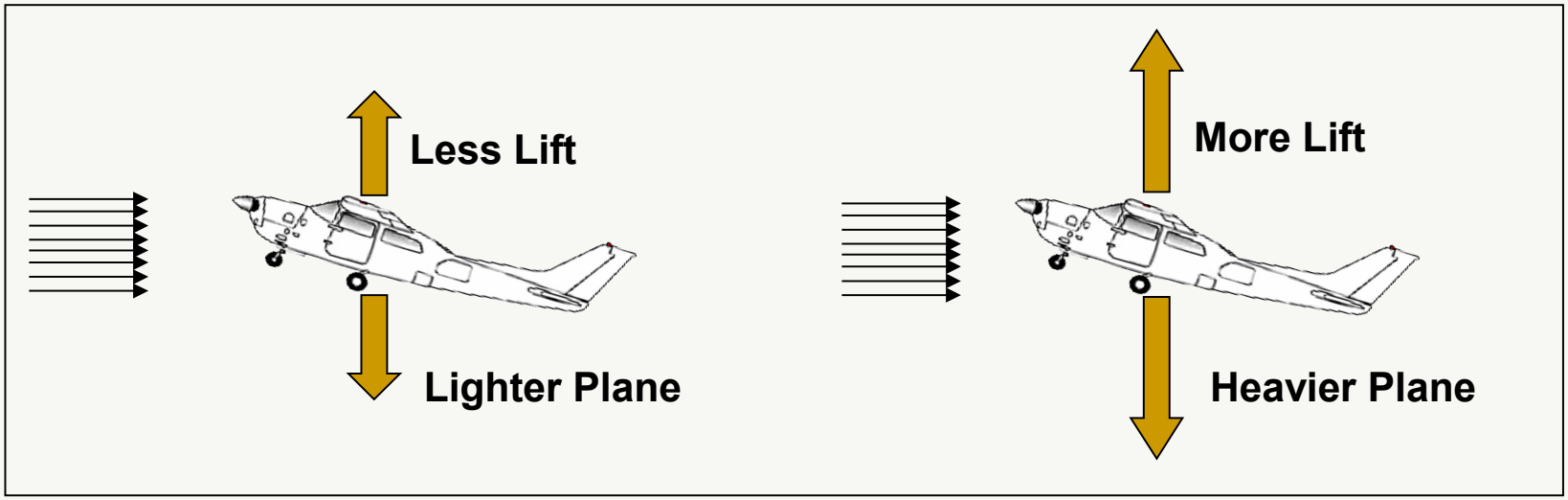
A plane can be stalled at ANY attitude.

Considerations

- ✓ Ailerons in Stall Recovery
- ✓ Stalling Speeds
  - Weight
  - Centre of Gravity
  - Power
  - Flaps
  - Load Factor
  - Plane Condition.

Stall Speeds: Weight

JUST PRIOR TO STALL



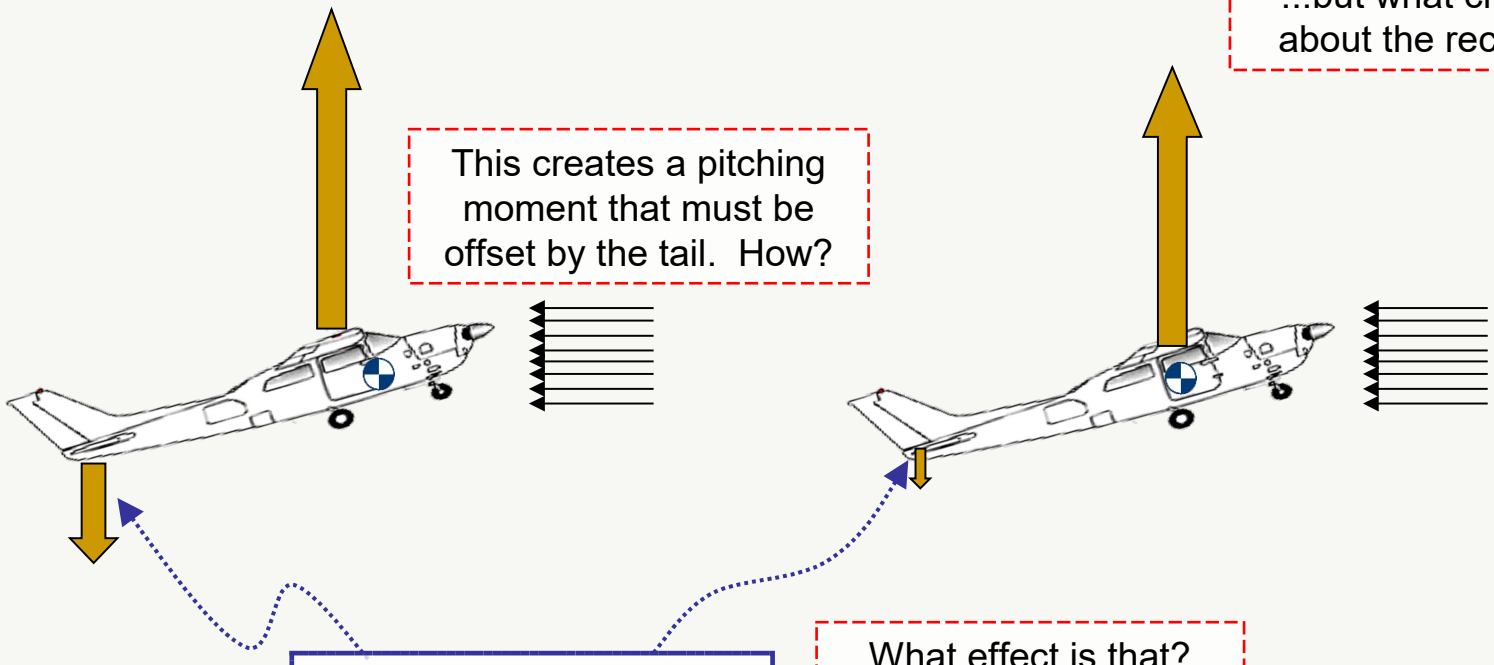
Wing always stalls at same Angle of Attack (AoA)-without an angle of attack vane, we use speed...which varies a lot

Flaps out, ice or bugs on the wing-that makes a new wing-new stall AoA

Stall Speeds: Centre of Gravity

FORWARD CENTRE OF GRAVITY
increases stall speed

AFT CENTRE OF GRAVITY
decreases stall speed



This creates a pitching moment that must be offset by the tail. How?

...but what changes about the recovery?

What effect is that?

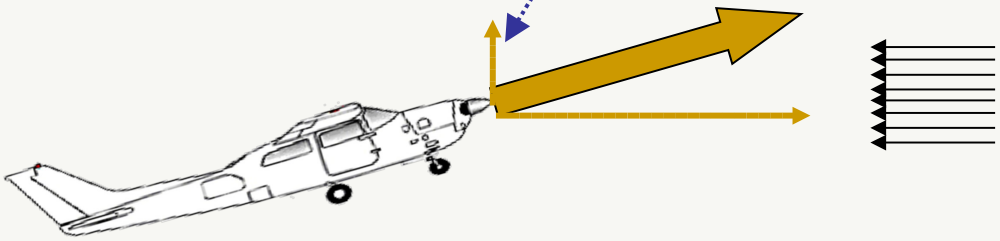
Same effect as additional weight

So… how can we summarize the effect of centre of gravity on stall speed?

For what C of G location are the POH stall speeds?

Stall Speeds: Power

Same effect as adding lift or removing weight



What effect does blowing air over the wing have?

POWER decreases stall speed

POH stall speeds are given for what power setting?

Stall Speeds: Flaps

Flaps increase lift for a given airspeed

FLAPS decrease stalling speed

Compare POH stall speeds for different flap settings.

Stall Speeds: Load Factor

$$\text{LOAD FACTOR} = \frac{\text{Lift}}{\text{Weight}}$$

What manoeuvres increase load factor?

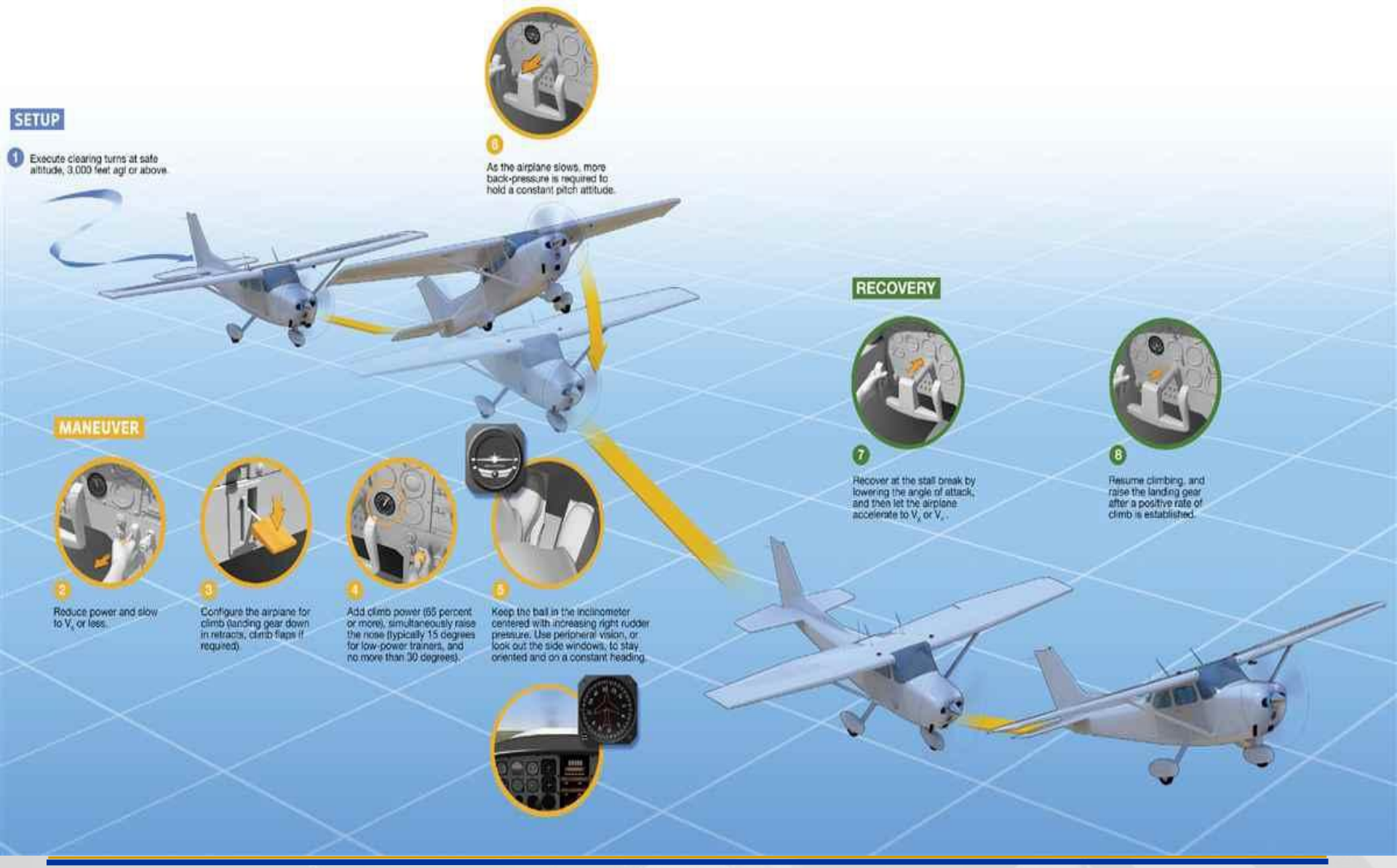
TURNS

ABRUPT PITCH-UP

How gentle would a panic turn in a canyon be?

Compare POH stall speeds for different bank angles.

It’s possible to stall an aircraft at ANY airspeed!


SETUP
1 Execute clearing turns at safe altitude, 3,000 feet agl or above.
6
As the airplane slows, more back-pressure is required to hold a constant pitch attitude.
MANEUVER
2
Reduce power and slow to V_A or less.
3
Configure the airplane for climb (landing gear down in retracts, climb flaps if required).
4
Add climb power (65 percent or more), simultaneously raise the nose (typically 15 degrees for low-power trainers, and no more than 30 degrees).
5
Keep the ball in the inclinometer centered with increasing right rudder pressure. Use peripheral vision, or look out the side windows, to stay oriented and on a constant heading.
RECOVERY
7
Recover at the stall break by lowering the angle of attack, and then let the airplane accelerate to V_X or V_Y.
8
Resume climbing, and raise the landing gear after a positive rate of climb is established.

Power-off Stall: Entry

- ✓HALT Check
- ✓Power idle
- ✓Pitch up to maintain altitude
- ✓Control yaw with rudder.

Power-Off Stall: Recovery

- ✓ Pitch down to just below cruise attitude
- ✓ Full power
- ✓ Carb heat cold
- ✓ Maintain directional control with rudder
- ✓ Gradually pitch up as airspeed increases
- ✓ Climb to initial altitude.

What might happen if you pull up abruptly?

Power-on Stall: Entry

- ✓ HALT Check
- ✓ Power to desired setting (1500-1900 rpm)
- ✓ Pitch up to maintain altitude
- ✓ Lower flaps once below V_{FE}, if desired
- ✓ Control yaw with rudder.

Power-on Stall: Recovery

- ✓ Pitch down to just below cruise attitude
- ✓ Maintain directional control with rudder
- ✓ Full power
- ✓ Carb heat cold
- ✓ Retract flaps in stages, as airspeed increases
- ✓ Gradually pitch up as airspeed increases and Climb to initial Altitude

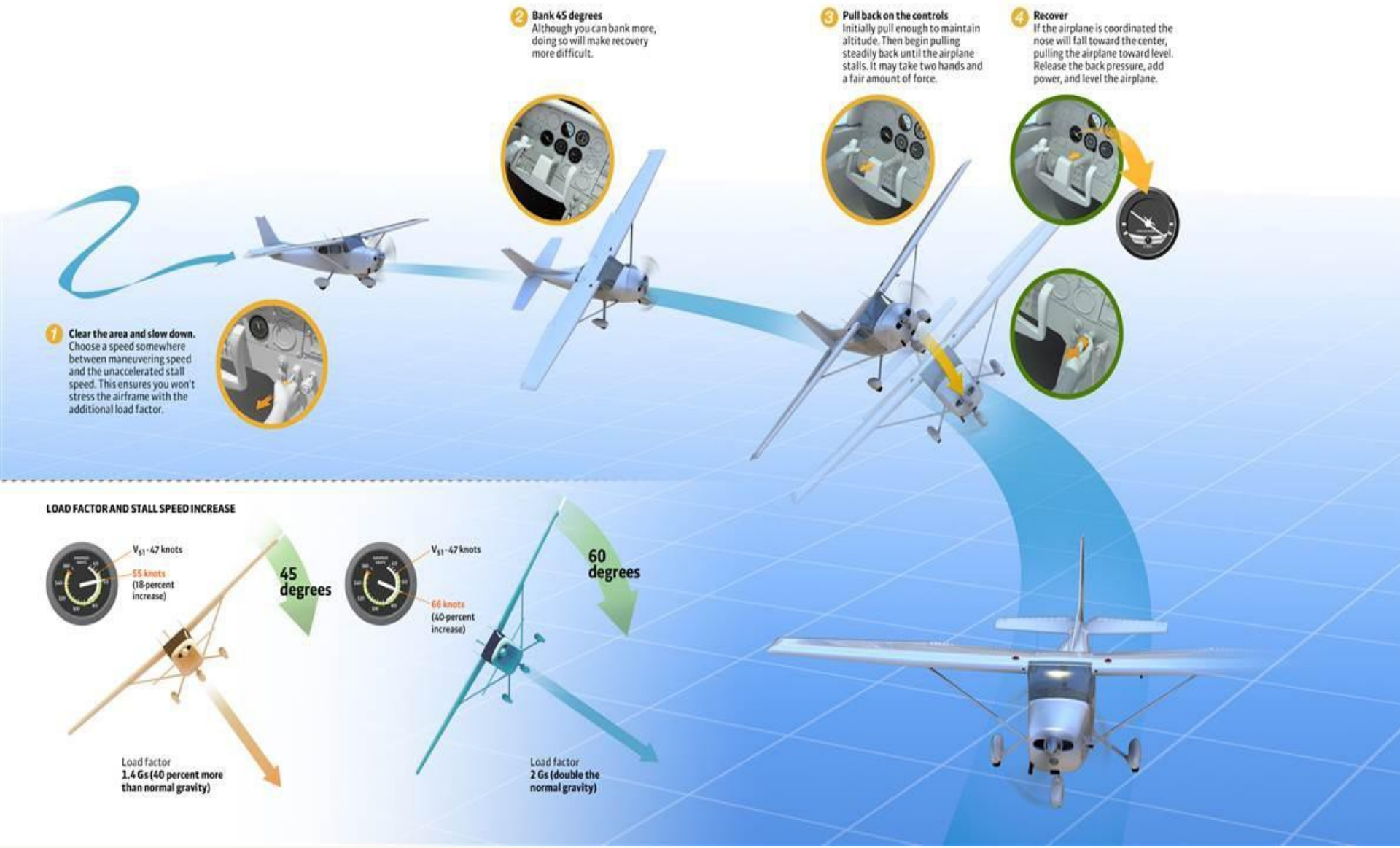
SAFETY

- Always perform HALT check before practicing stalls
- Control yaw with rudder- uncoordinated stall may turn into a spin!
- Avoid excessive pitching down and abrupt pulling up on recovery

WHEN YOU ARE LOW & SLOW

- Watch your airspeed
- Avoid steep turns.

Stall in a Turn - more rudder to recover-start of a spin



Review

What causes a wing to stall?

What are the symptoms of an approaching stall?

One of the wings drops sharply as you perform a power-on stall. How to correct that?

When pulling up from a dive during stall recovery, it is possible to stall the plane at a higher than published stall speed. Why?

Why should you avoid steep turns at low airspeed?

Conclusion

- ✓ Stalls are a fun maneuver that lets you explore the limits of the plane's performance and help prepare for making safe take-offs and landings
- ✓
- ✓ Read for next lesson: Ex. 13, Spins

QUESTIONS?