Ex. 9b – Steep Turns

What you will learn and Why:

How to perform coordinated steep (30°+) turns, including:

- level 45° turns
- collision-avoidance turns
- descending steep turns.

Precision Exercise

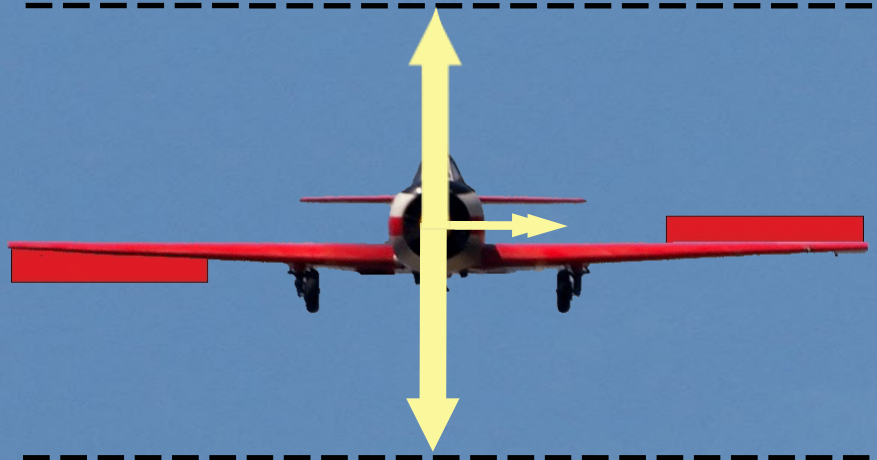
Emergency Manoeuvres

Theories and Definitions:

- ✓ Altitude Control in a Steep Turn
- ✓ Bank Control in a Steep Turn
- ✓ Attitude Indicator: Quick Review.

Altitude Control in a Steep Turn

MEDIUM TURN



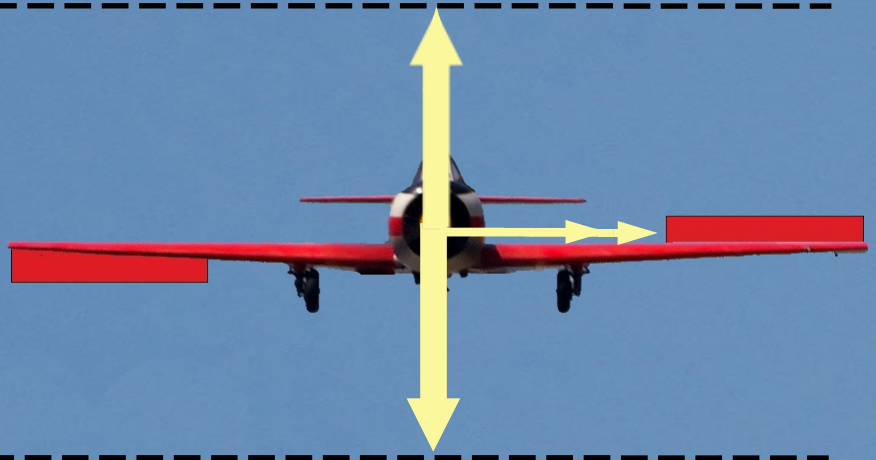
15° Load Factor = 1.04
4% more lift is required

30° Load Factor = 1.15
15% more lift is required

Medium turns: slight back pressure is sufficient to maintain altitude

How did we maintain altitude in gentle and medium turns?

STEEP TURN



45° Load Factor = 1.41
41% more lift is required

60° Load Factor = 2.0
100% more lift is required

Steep turns: extra power necessary to safely maintain altitude

How can we maintain altitude in a steep turn?

Bank Control In a Steep Turn

Gentle turn (up to 15°)

- speed/lift difference between wings is small
- plane wants to return to level flight due to built-in stability
- slight Control Column pressure in direction of turn may be needed

Which wing is traveling faster?

Medium turn (15° - 30°)

- plane wants to maintain bank angle
- neutralize Control Column

May need slight aileron pressure in direction opposite turn

Steep turn (over 30°)

- plane wants to increase bank angle
- "counter steering" may be required

Which wing is producing more lift?

This makes the plane want to keep turning!

Review: Attitude Indicator in a Turn

Procedures

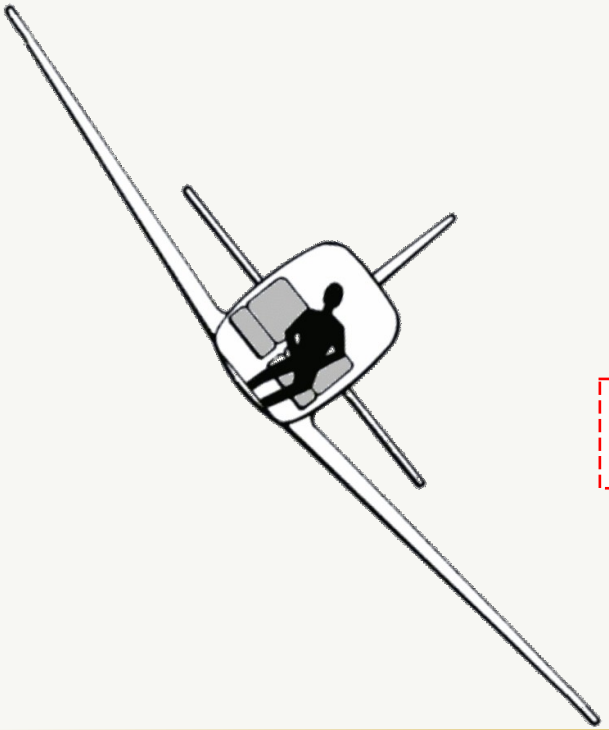
- Steep Turn
  - Entry
  - During
  - Recovery.

Seat Right

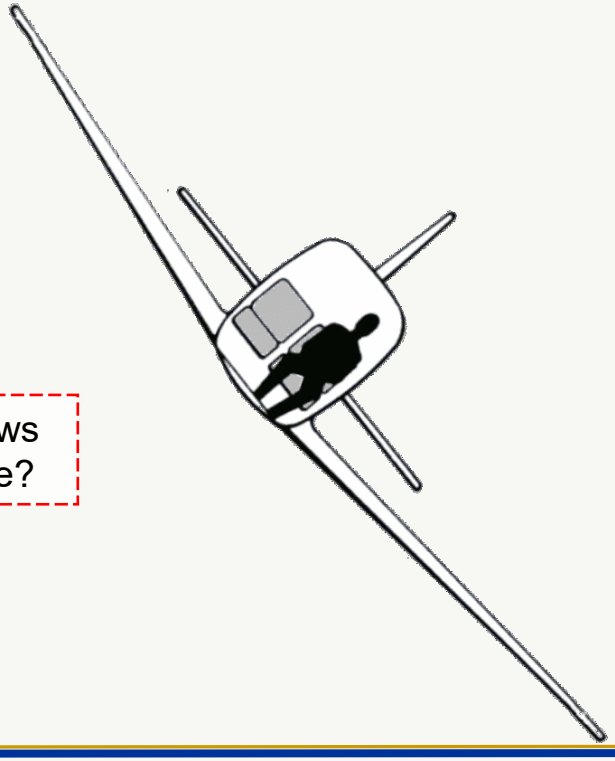
- ✓ Visual picture will be different for left and right turns

Why?

- ✓ Correct posture is crucial for accurate turns

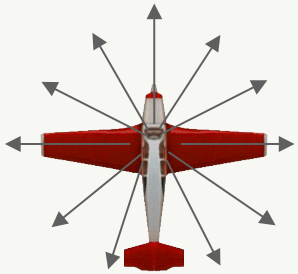


Which picture shows the correct posture?



45° Level Steep Turn: Entry

- ✓ Look-out, finishing in direction of intended turn
- ✓ Turn Control Column (CC)in direction of intended turn
- ✓ Control adverse yaw with rudder
- ✓ Control the pitch-down tendency with gradually increasing back pressure
- ✓ As plane rolls through 30°, add “a touch” of power
- ✓ At 45° angle of bank, return CC close to neutral
- ✓ Correct change in yaw as necessary.



45° Level Steep Turn: During

- ✓ Keep good look-out (especially in direction of the turn)
- ✓ Reference Attitude Indicator once to confirm 45° bank angle
- ✓ Reference Alt. occasionally to confirm level turn
- ✓ Maintain desired bank angle w/ ailerons
- ✓ Maintain altitude with elevators

  - small changes
  - anticipation!

- ✓ Maintain coordinated flight with rudder.

Level Turn: During

45° Level Steep Turn: Recovery

Begin leveling out at half the angle of bank

- ✓ Keep good look-out (especially in direction of the turn)
- ✓ Turn Control Column in direction opposite the turn
- ✓ Correct yaw with rudder
- ✓ Slight forward pressure to maintain altitude
- ✓ As plane rolls through 30°, reduce power
- ✓ When plane is level, neutralize Control Column.

Applications and Considerations:

- ✓ APPLICATIONS
  - Canyon Turn
  - Collision-Avoidance Turn
  - Descending Steep Turn

- ✓ CONSIDERATIONS
  - Left vs. Right Turns: Visual Picture
  - Posture.

Canyon Turn

- ✓ Tightest (smallest radius) safe turn
- ✓ Can be used to reverse direction in a canyon or approaching mountain range

lower airspeed

+

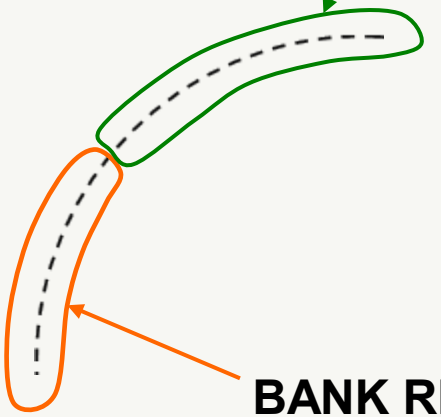
increase angle of bank

FLAPS!

- more lift (helps decrease stall speed)
- more drag (more power will be required to maintain airspeed)

Collision-Avoidance Turn

Which way should each plane turn?



INCREASE AIRSPEED & STRAIGHTEN OUT

- ✓ **full power**
- ✓ **ailerons close to neutral**
- ✓ **return to straight flight**

How long does it take to execute this manoeuvre?

10 seconds

BANK RIGHT & DECREASE AIRSPEED

- ✓ **power idle**
- ✓ **Control Column pull back**
- ✓ **sharp Control Column deflection to the right**

Descending Steep Turn

What is a possible application of such a turn?

- ✓ Can be used to descend through a small hole in the cloud
- ✓ DANGER: Can easily turn into a spiral dive!
- ✓ Careful control of airspeed and bank angle is required!

SAFETY

Lift wing before turn to check your “blind spot”

- **Look-out** especially critical for steep turns

- Keep entry speeds within POH limits

- **POWER**
  - TOO LITTLE = low airspeed, close to a stall
  - TOO MUCH = danger of “redlining” the engine

- **PITCH**
  - TOO NOSE-UP = reduced airspeed (close to a stall)
  - TOO NOSE-DOWN = increased airspeed, spiral dive may develop

- **BANK**
  - TOO LITTLE = not a safety issue… but not a steep turn either!
  - TOO MUCH = over banking tendency, increased load factor; may lead to a stall (if altitude is maintained) or spiral dive (if nose is allowed to drop).