

# Exercise 9 - Turns



# Aim:

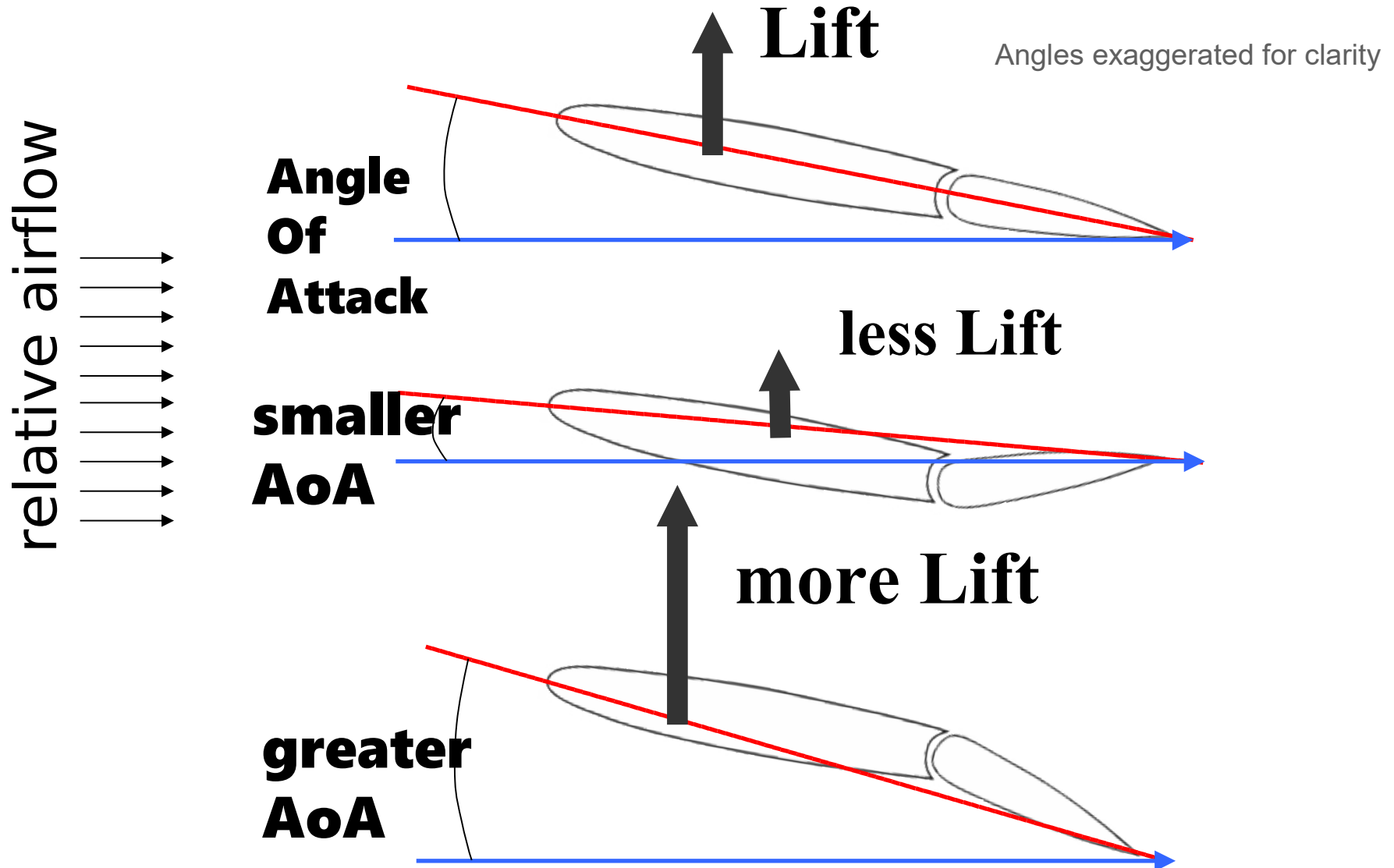
- ✓ How to enter, maintain and recover from gentle and medium turns
- ✓ How to accurately turn to a desired heading.

Steep turns covered in a later lesson. Stay tuned!

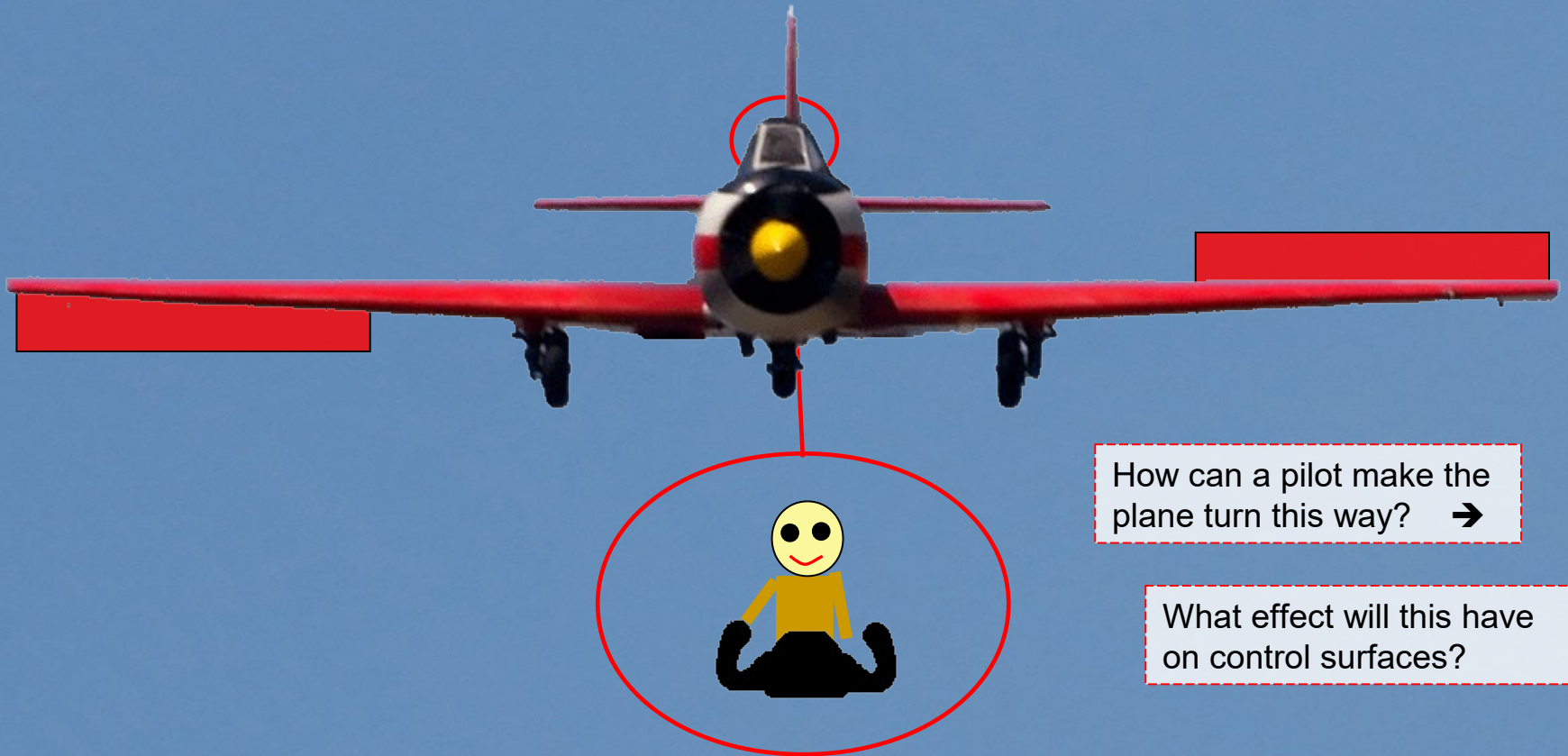
# Why learn this:

- ✓ Can't fly in a straight line all the time!
- ✓ Important to make precise and coordinated turns for:
  - Safety
  - passenger comfort
  - overall flying proficiency and accuracy.

# What Makes a Plane Turn?



# What Makes a Plane Turn?



# Types of Turns

## **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 back pressure in  
direction of turn may be needed**

## **Medium turn (15°-30°)**

**plane wants to maintain bank angle  
neutralize Control Column**

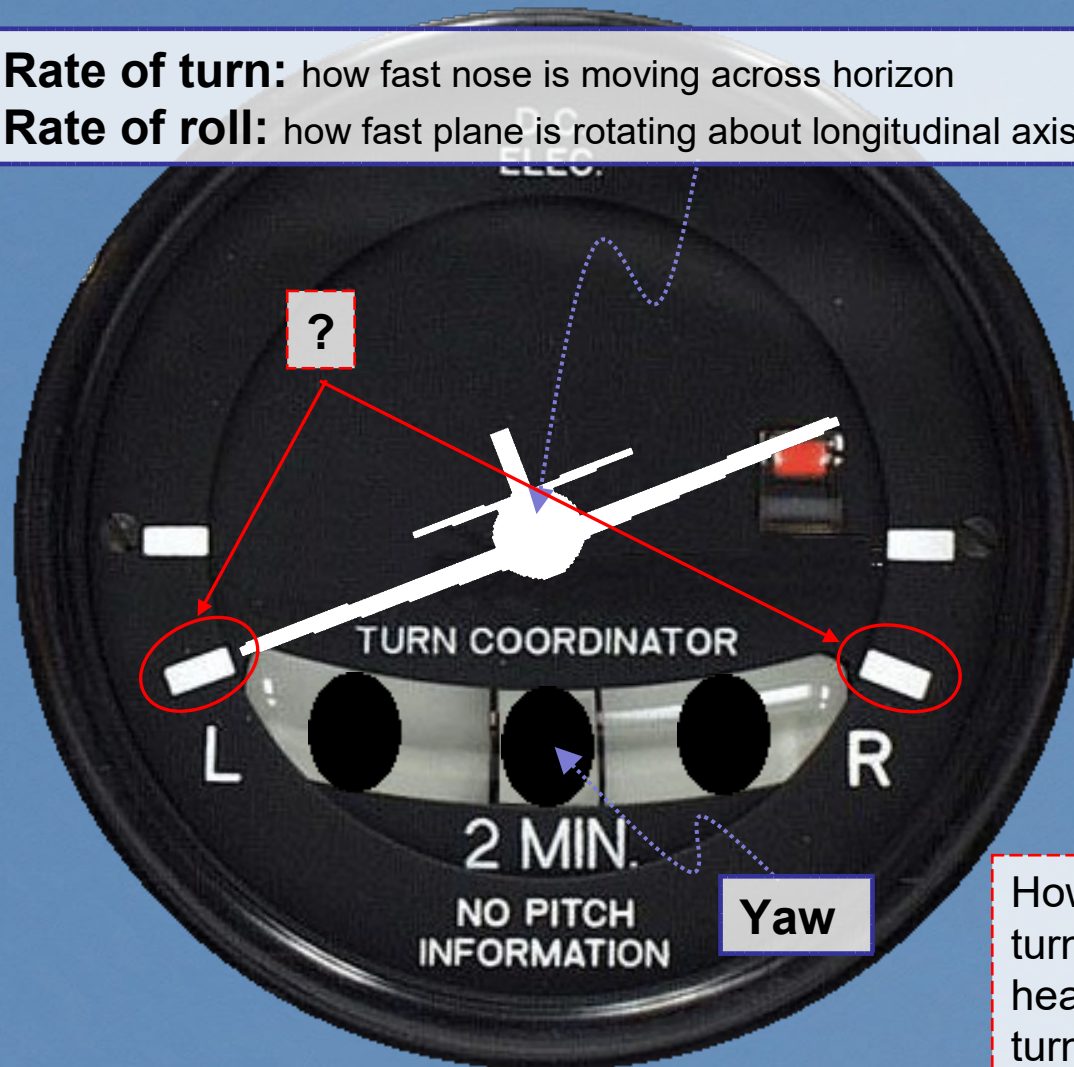
# Attitude Indicator in a Turn



# Turn Coordinator in a Turn

**Rate of turn:** how fast nose is moving across horizon

**Rate of roll:** how fast plane is rotating about longitudinal axis



What information does the ball provide?

What information does the miniature airplane provide?

What kind of turn the plane is in? (Left, right? Coordinated, slipping, skidding?)

Now?

Rate One Turn  
=  
3 degrees per second

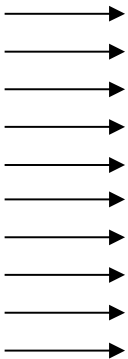
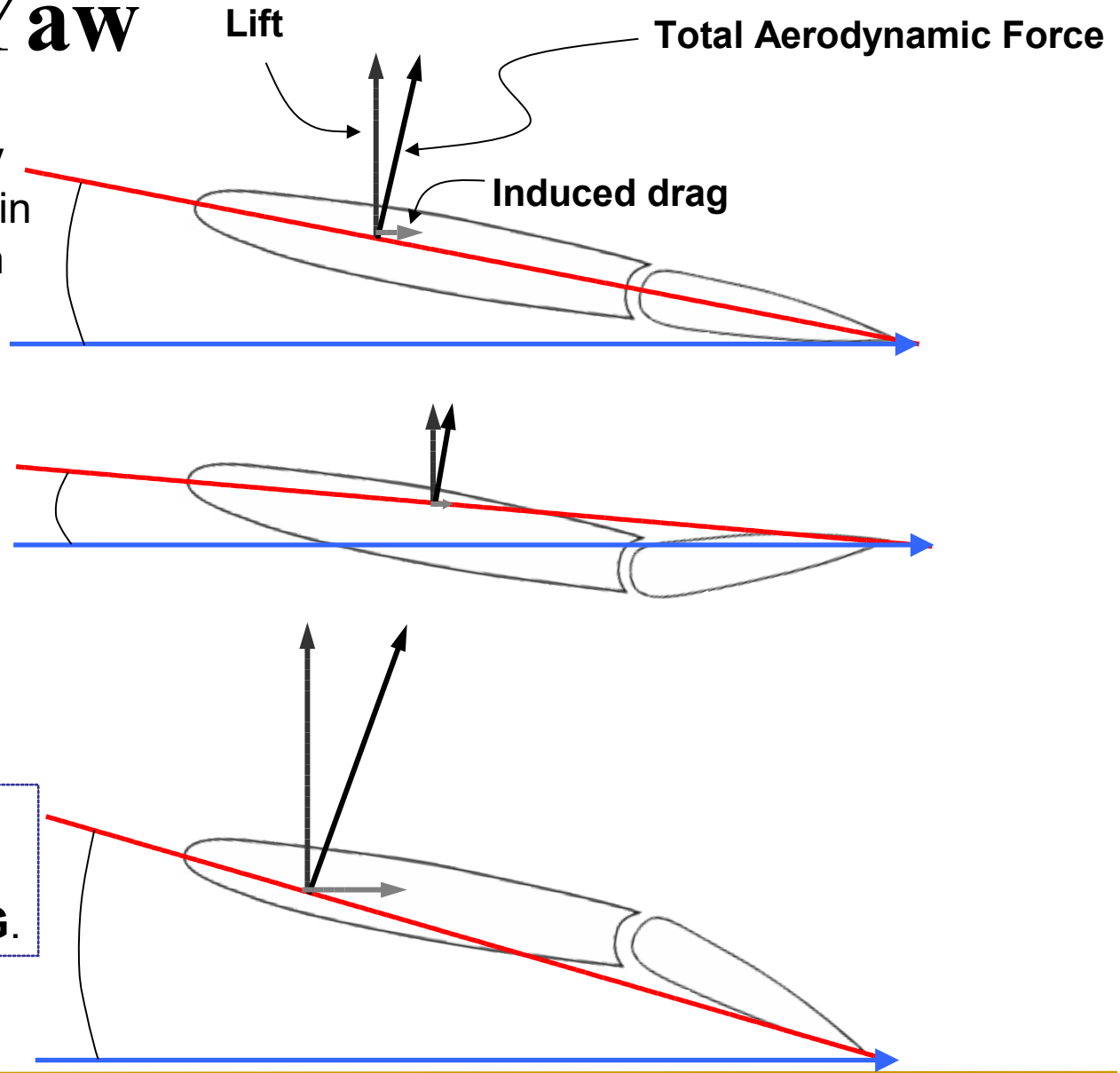
How long will it take to turn from heading 210 to heading 150 at rate one turn?



# Adverse Yaw

is the natural and undesirable tendency for an aircraft to yaw in the opposite direction of a roll.

relative airflow

# Adverse Yaw

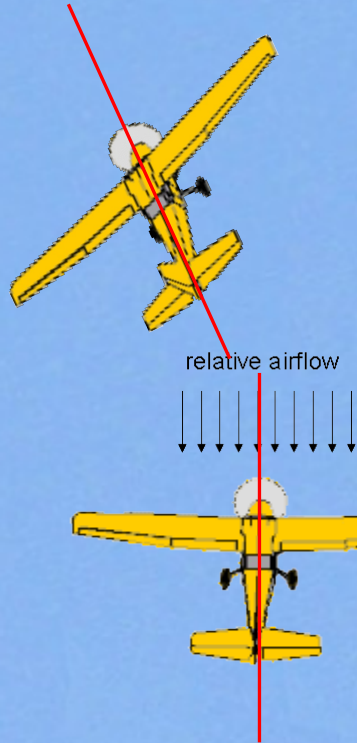
Which side will the ball be on?

How can you fix this problem?

Which wing is producing more drag?

What effect will this have on yaw?

COORDINATED TURN



relative airflow

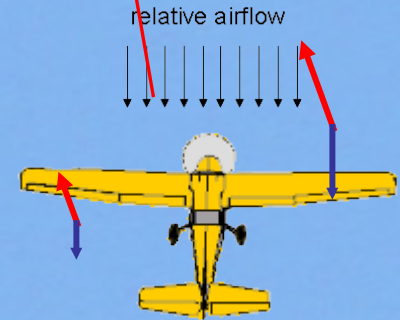


Which way will the miniature plane be tilted?



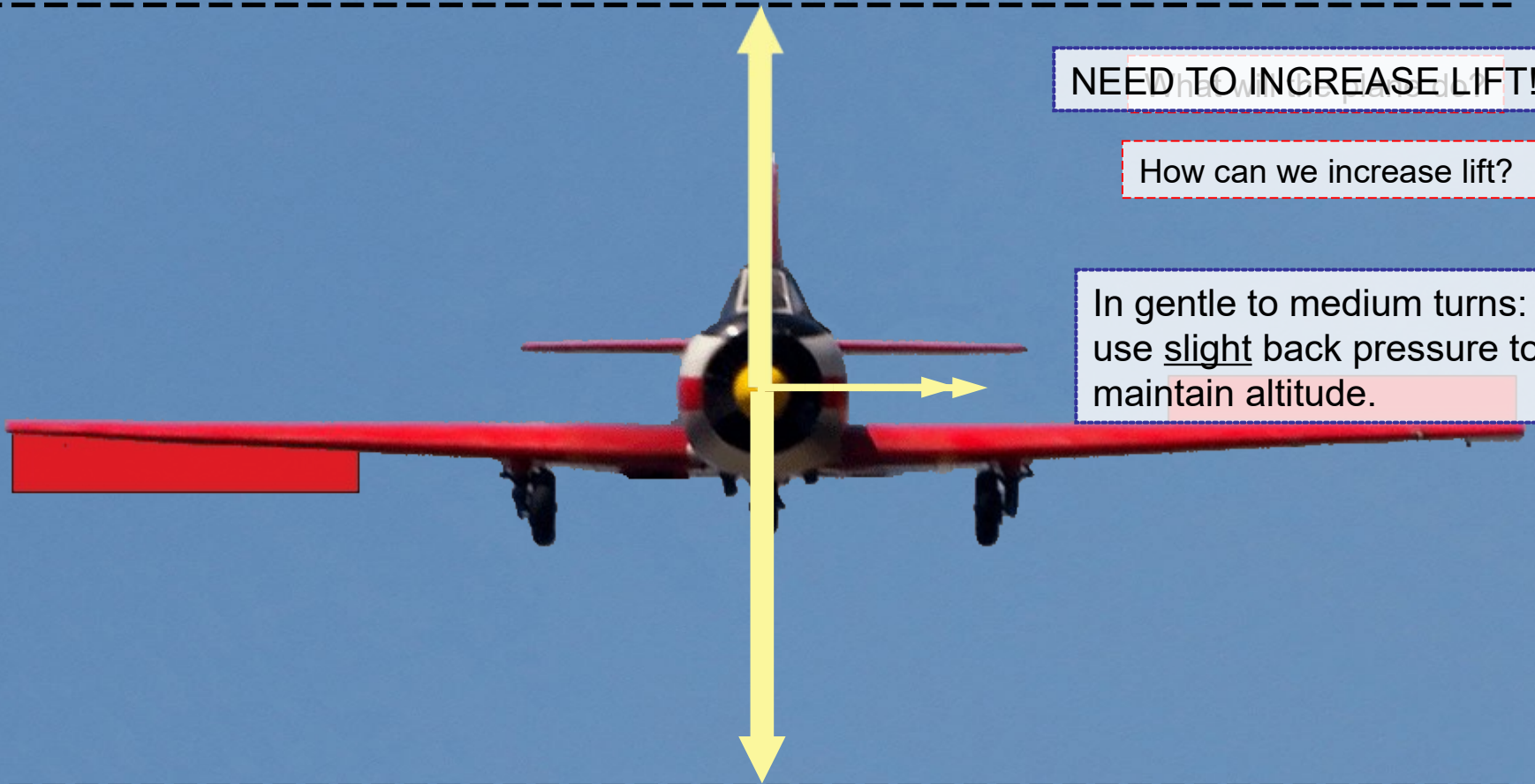
What's the direction of relative airflow?

ADVERSE YAW EFFECTS



relative airflow

# Pitch and Altitude in a Turn



NEED TO INCREASE LIFT!

How can we increase lift?

In gentle to medium turns:  
use slight back pressure to  
maintain altitude.

# Load Factor in a Turn

**LOW AIRSPEED?**

**GENTLE TURNS  
ONLY!**

$$\text{Load factor} = \frac{\text{Lift}}{\text{Weight}}$$

Higher load factor → higher stall speed!

POH...

# Procedures

- **Level Turn**
  - **Entry**
  - **During (gentle & medium turns)**
  - **Recovery**

# Level Turn: Entry

- ✓ **Look-out** in direction of intended turn
- ✓ Turn control column in direction of intended turn
- ✓ Anticipate and correct adverse yaw with rudder
- ✓ At desired angle of bank, return control column close to neutral
- ✓ Correct change in yaw as necessary.

# Level Turn: During

- ✓ Keep good **look-out**  
(especially in direction of the turn)
- ✓ Maintain desired bank angle with aileron inputs
- ✓ Maintain altitude with elevators
- ✓ Maintain coordinated flight with rudder.

# Gentle Level Turn:





# Medium Level Turn:

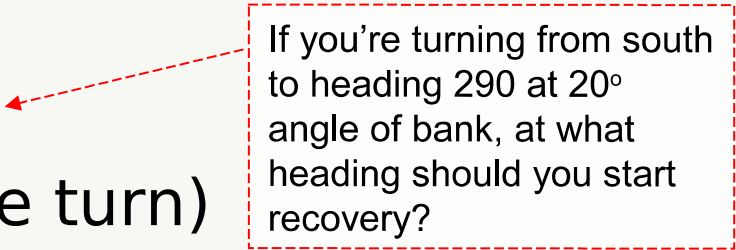


# Level Turn: Recovery

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
- ✓ When plane is level, neutralize control column.



If you're turning from south to heading 290 at 20° angle of bank, at what heading should you start recovery?

# Considerations

- ✓ Turn Radius and Rate
  - Effect of Bank Angle
  - Effect of Airspeed
  
- ✓ Rate One Turns.

# Turn Radius & Rate: Effect of Bank Angle

Greater Bank Angle  
=  
Smaller Turn Radius  
Greater Rate of Turn



Which plane will have a smaller turn radius?



90 KT

# Turn Radius & Rate: Effect of Airspeed

Lower Airspeed  
=  
Smaller Turn Radius  
Greater Rate of Turn

Which plane will have a smaller turn radius?

140 KT



70 KT



# Rate One Turns



“Rule of Thumb”

bank angle for rate one turn  
=
   
TAS/10 + 7 (knots)

If you're flying at 90 knots, what should your bank angle be for rate one turn?

Both planes are doing a rate one turn. Which one will change heading by 90° first?



140 KT



70 KT

# SAFETY

**Look-out**, especially in direction of turn

- ! Climbing turns
  - ! must be gentle (operating close to stall!)
  - ! set up climb first, turn second
- ! During descending turns avoid over speeding the plane
- ! Correcting yaw is critical in a turn!

# Review

- Q Which way does the plane want to yaw after the Control Column is deflected left, and why?
- Q Are the numbers on the Heading Indicator increasing or decreasing in a right turn?
- Q How can you use the Turn Coordinator to know whether the plane is slipping or skidding?



# Conclusion

- ✓ Now you know how to perform Basic Turns
- ✓ This lesson builds a foundation for Climbing, Descending and advanced (steep) turns
- ✓ Read for next lesson: Ex. 10, Range and Endurance

**QUESTIONS?**