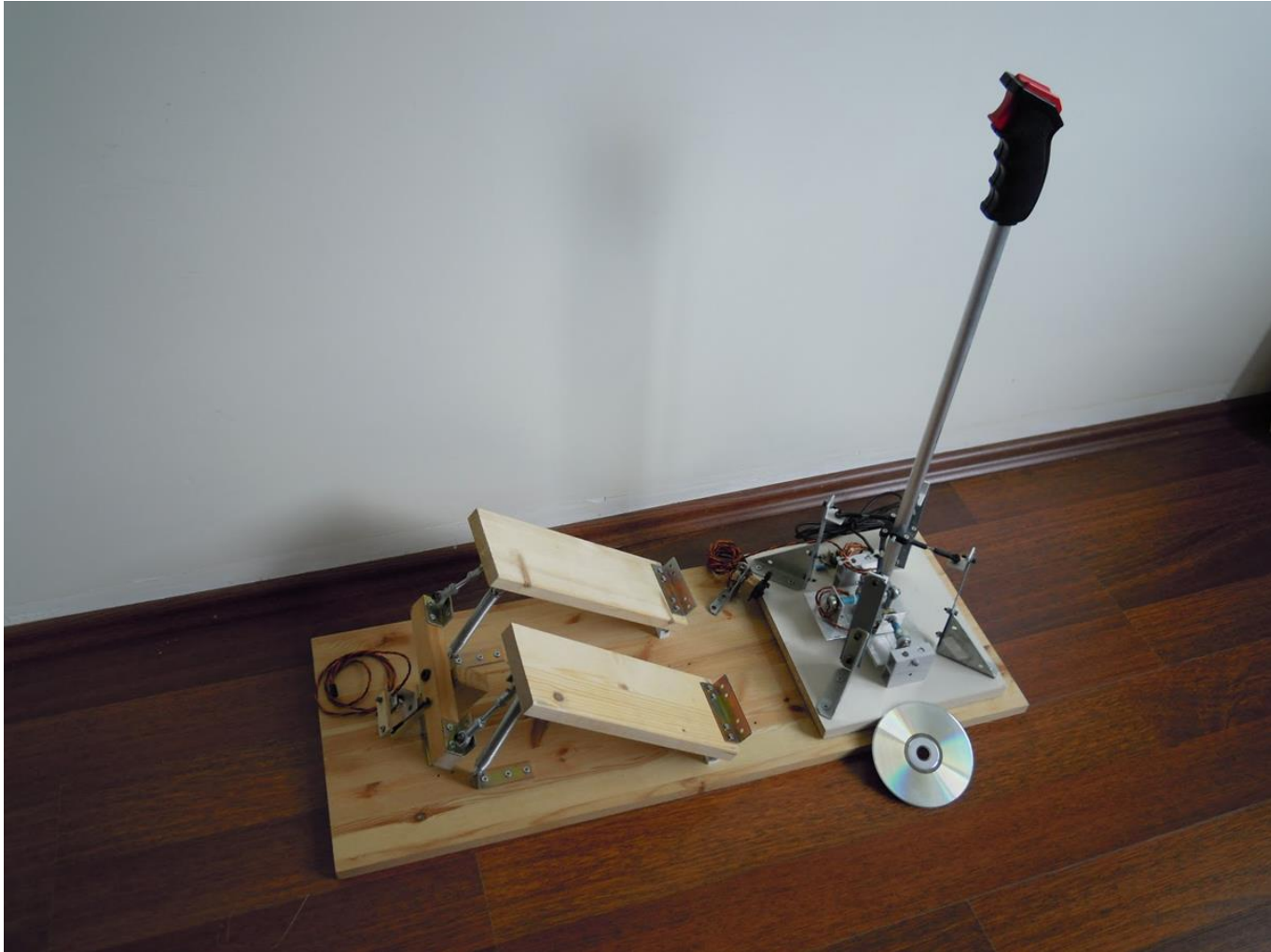


Stick and Rudder Flying

NMPA, 5-20-2020



Stick and Rudder

An Explanation of the Art of Flying



WOLFGANG LANGEWIESCHE

1944

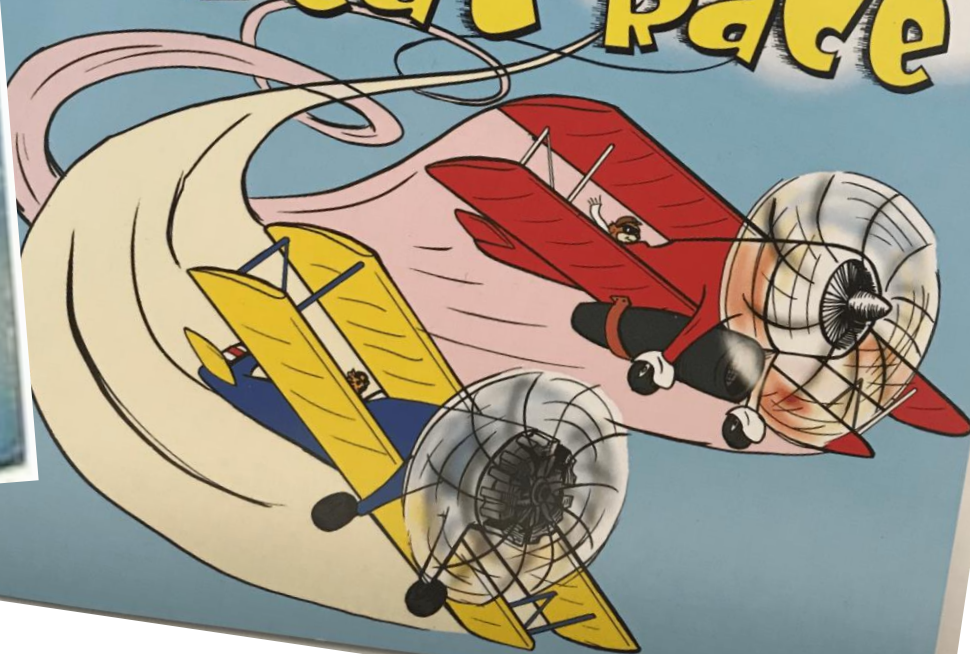
(available for free
at [Archive.org](https://archive.org))



The Adventures of
Stick & Rudder



**The
Great Race**



2006

What defines a stick and rudder pilot?

- A kinesthetic feel for coordinated flight
- Ability to make use of intentionally uncoordinated flight
- Awareness of how close the airplane is to departure from controlled flight
- Awareness of/precise correction for wind effects



What defines a stick and rudder pilot?

- Ability to use the controls with precision
- A feel for *changing* control pressures
 - At different airspeeds
 - At different attitudes
- Timing, Anticipation

Not just for airshows



Most airplanes, in *most* flight conditions do not need to be flown with precision

--Therefore--

Many pilots in fact do not fly that way

**You don't
need it until
you need it**



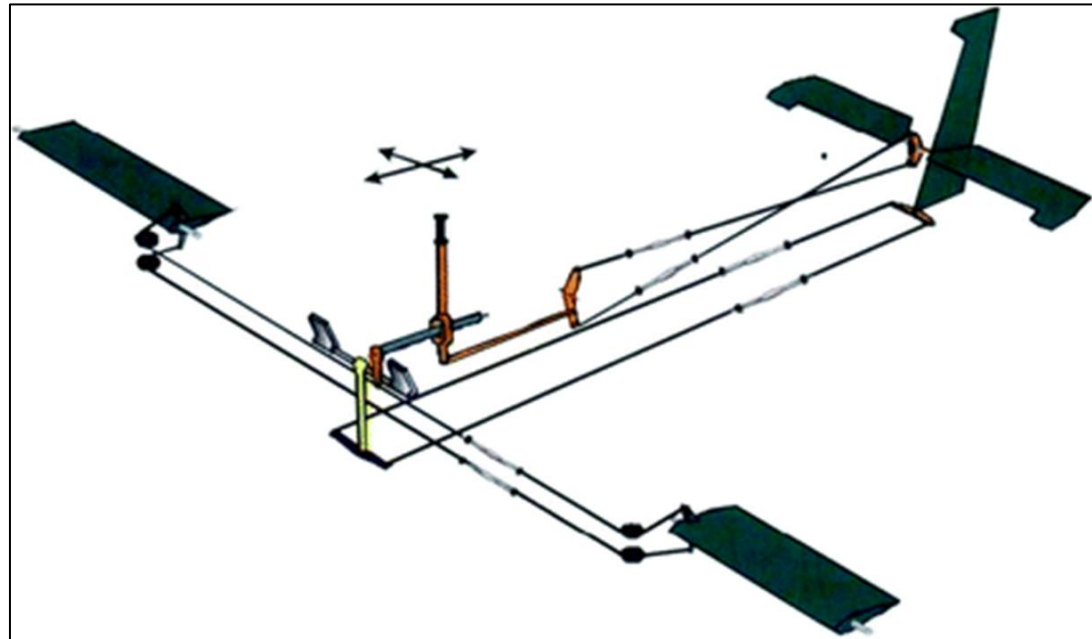
Are there *advantages* to flying with precision?

- At the edges of the envelope
 - Crosswind landings
 - Base-to final turn
 - Steep climbouts on takeoff
 - Forward vs. side slips
- Passenger comfort
- Bragging rights



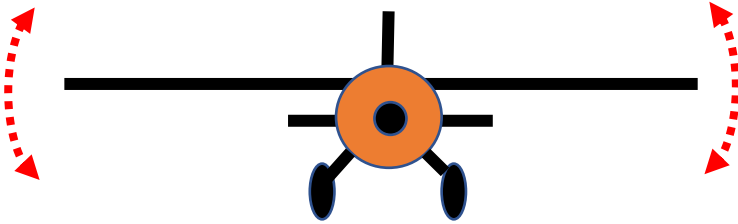
The Controls Include

- Stick
 - Ailerons
 - Elevator
- Rudder
- Flaps
- Throttle
- Trim

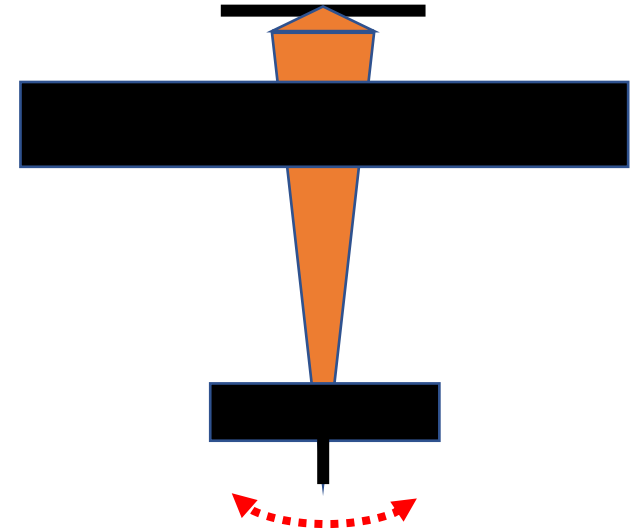


START SIMPLE

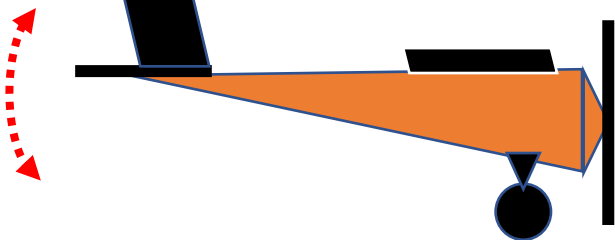
Wing waggles



Fish-tailing



Bobbing



Individual controls

- In cruise
- In slow flight
- Near the stall
- Different flap settings

Pop Quiz: How do you keep your wings level in turbulence?



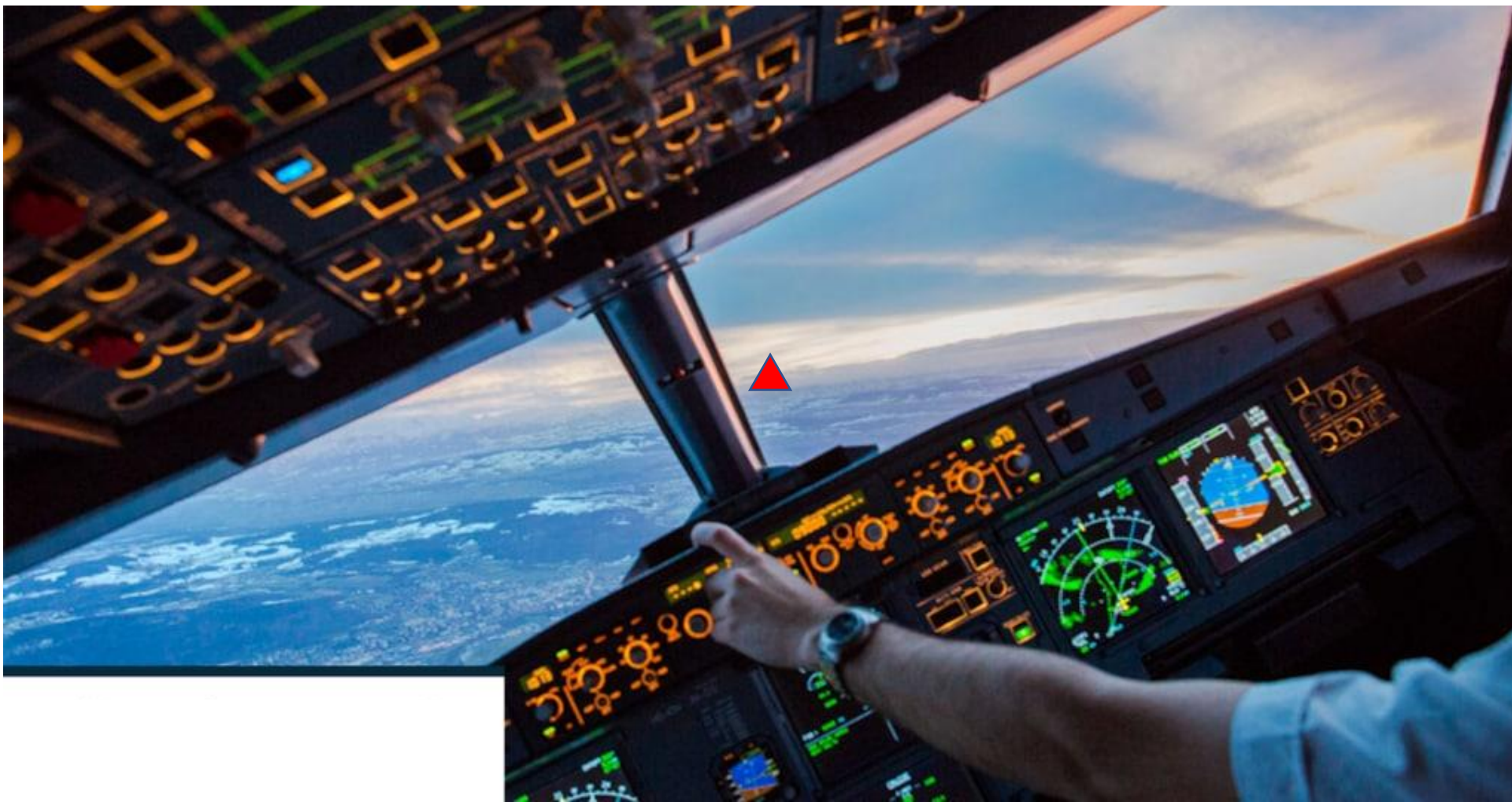
Your feet should be moving as often and as much as your hands.



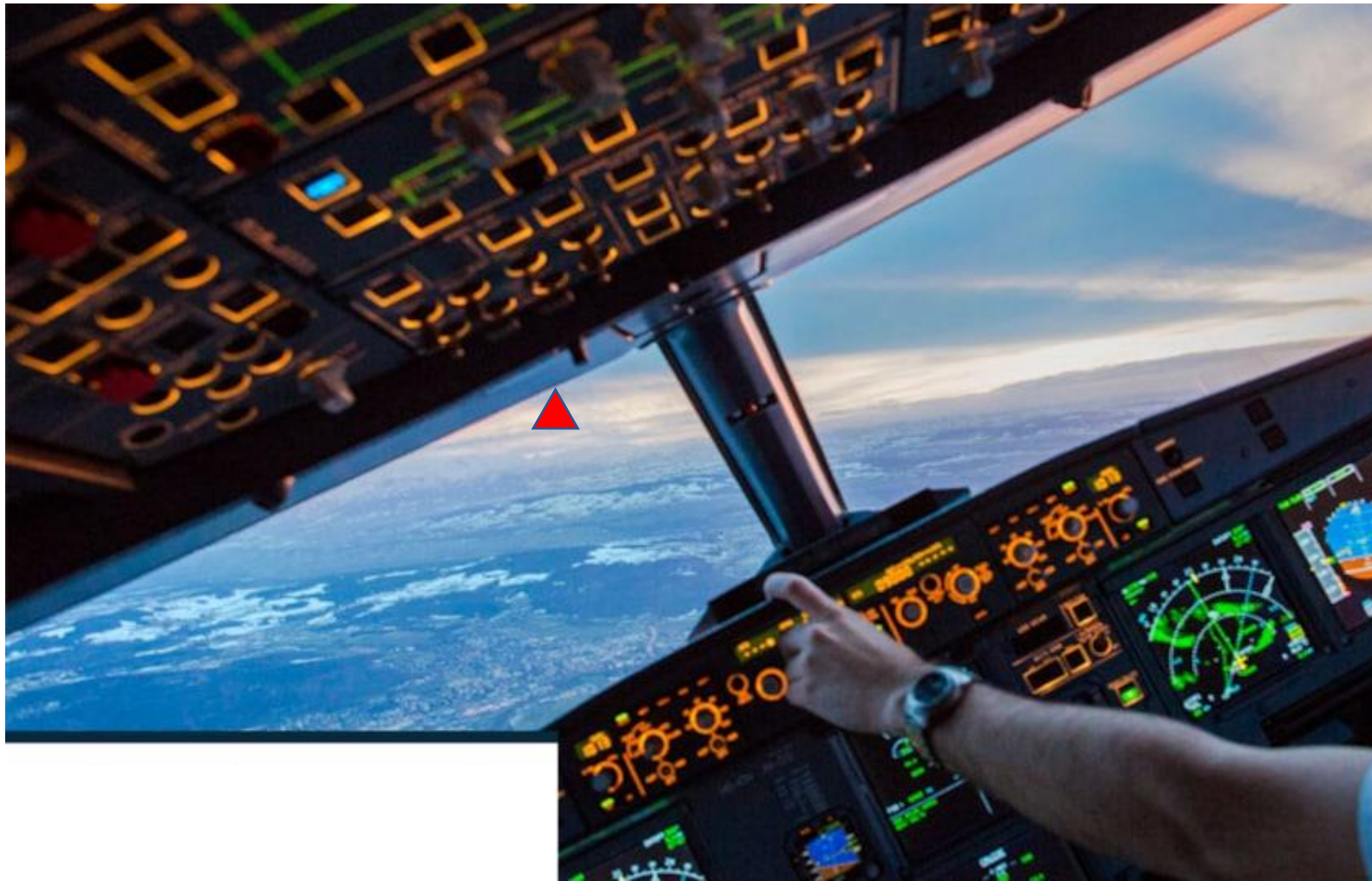
Exercise: Keep the nose on a point on the horizon while.....

- Rocking the wings with feet on the floor
- Rocking the wings while using the rudder





Nose on a point on the horizon, rock the wings



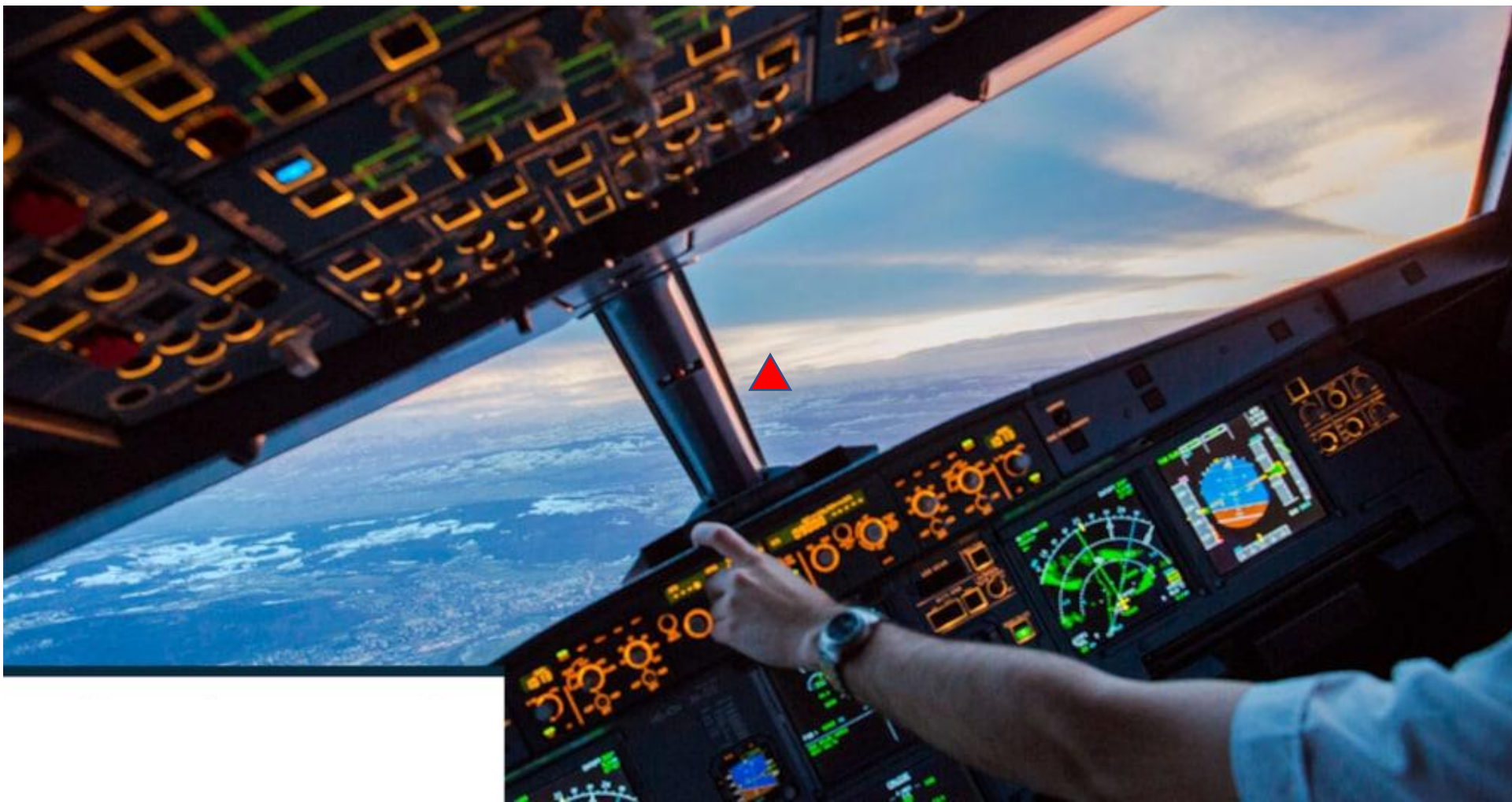
Nose wallows without rudder





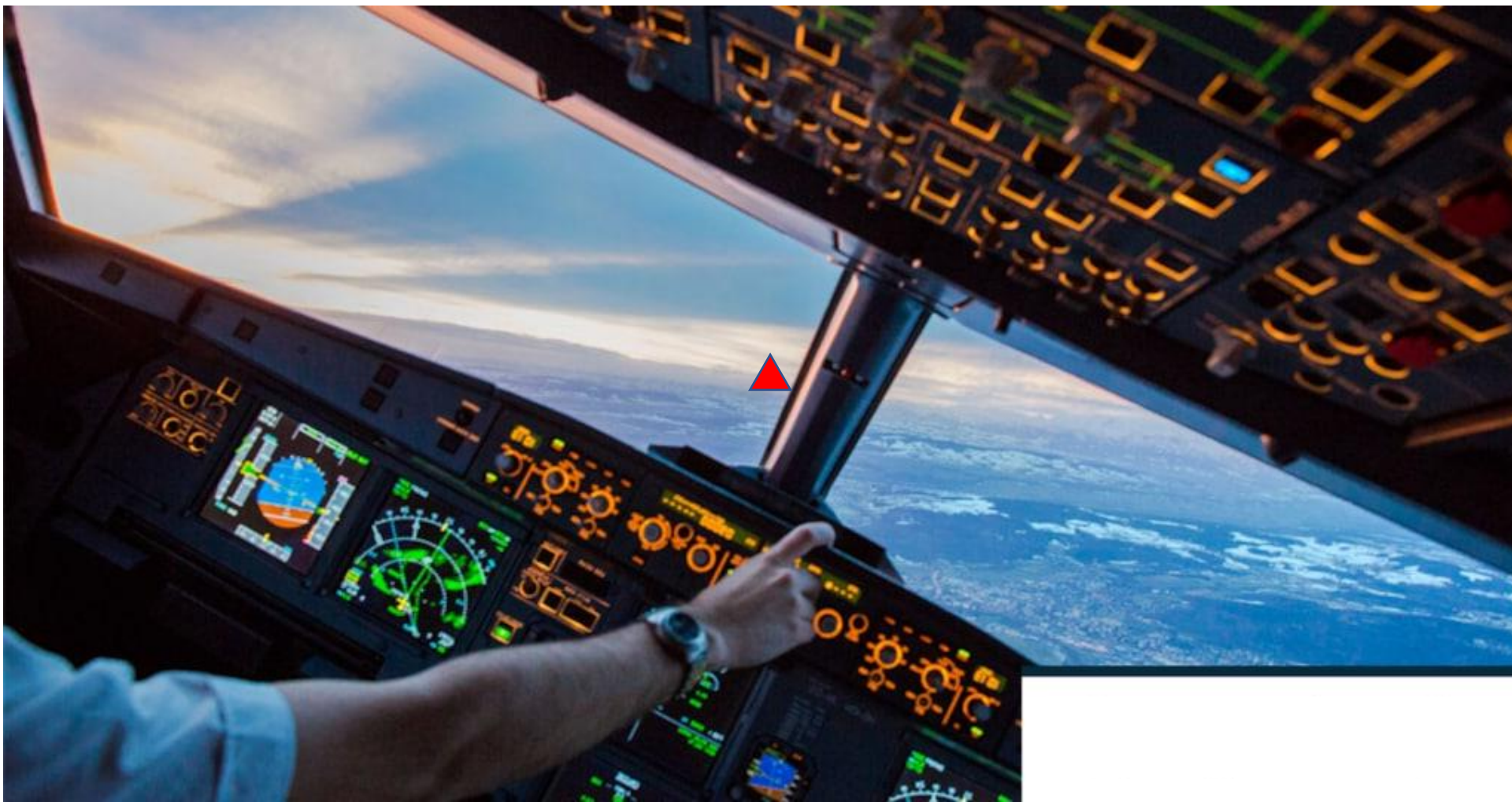
Nose wallows without rudder





Nose stays on the point with rudder





Nose stays on the point with rudder



THEORY: TURNS

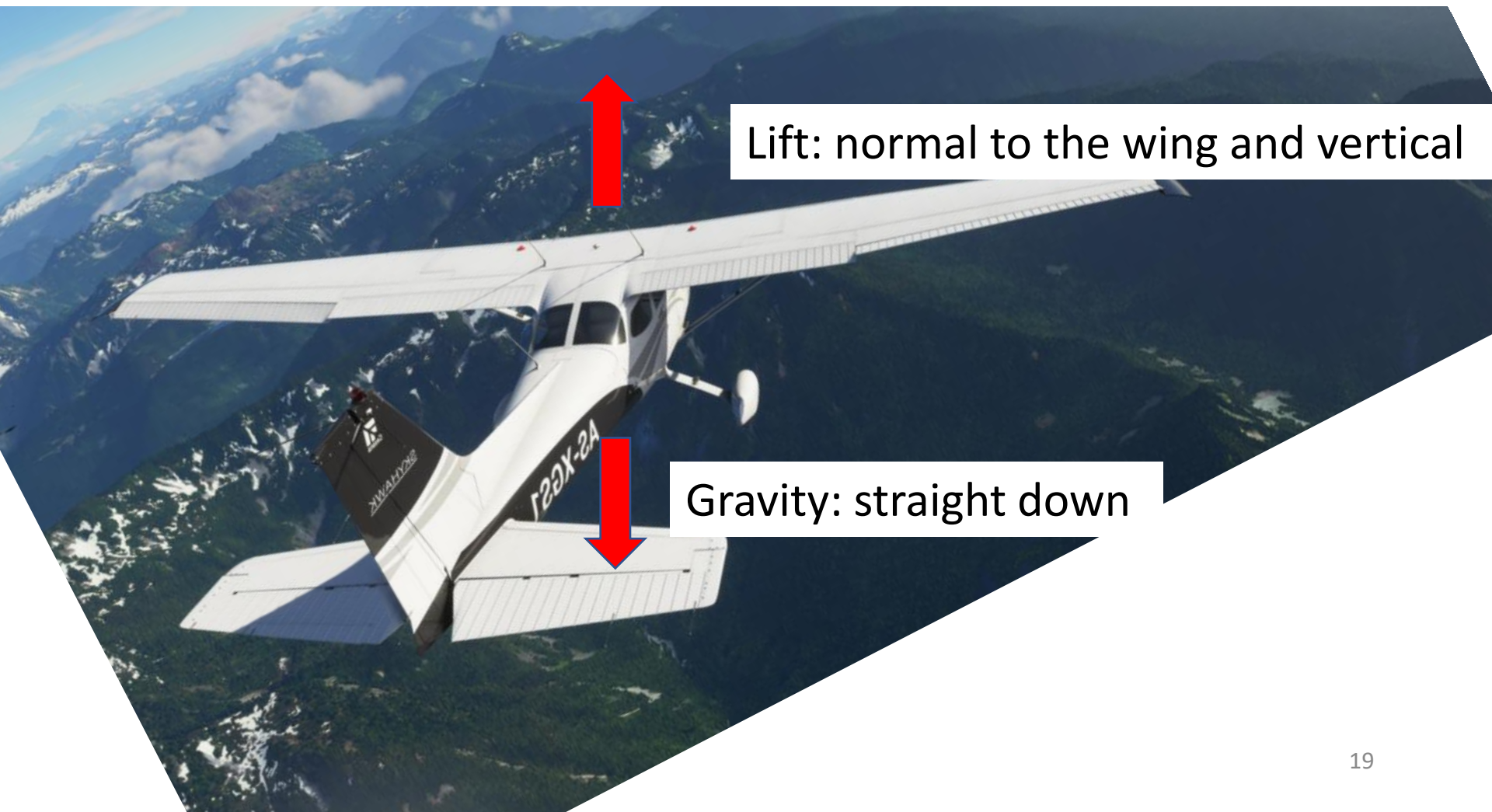
- The rudder is **only** needed to correct for adverse yaw.
- The rudder is **only** needed while the bank angle is changing.



So how *does* an airplane turn?

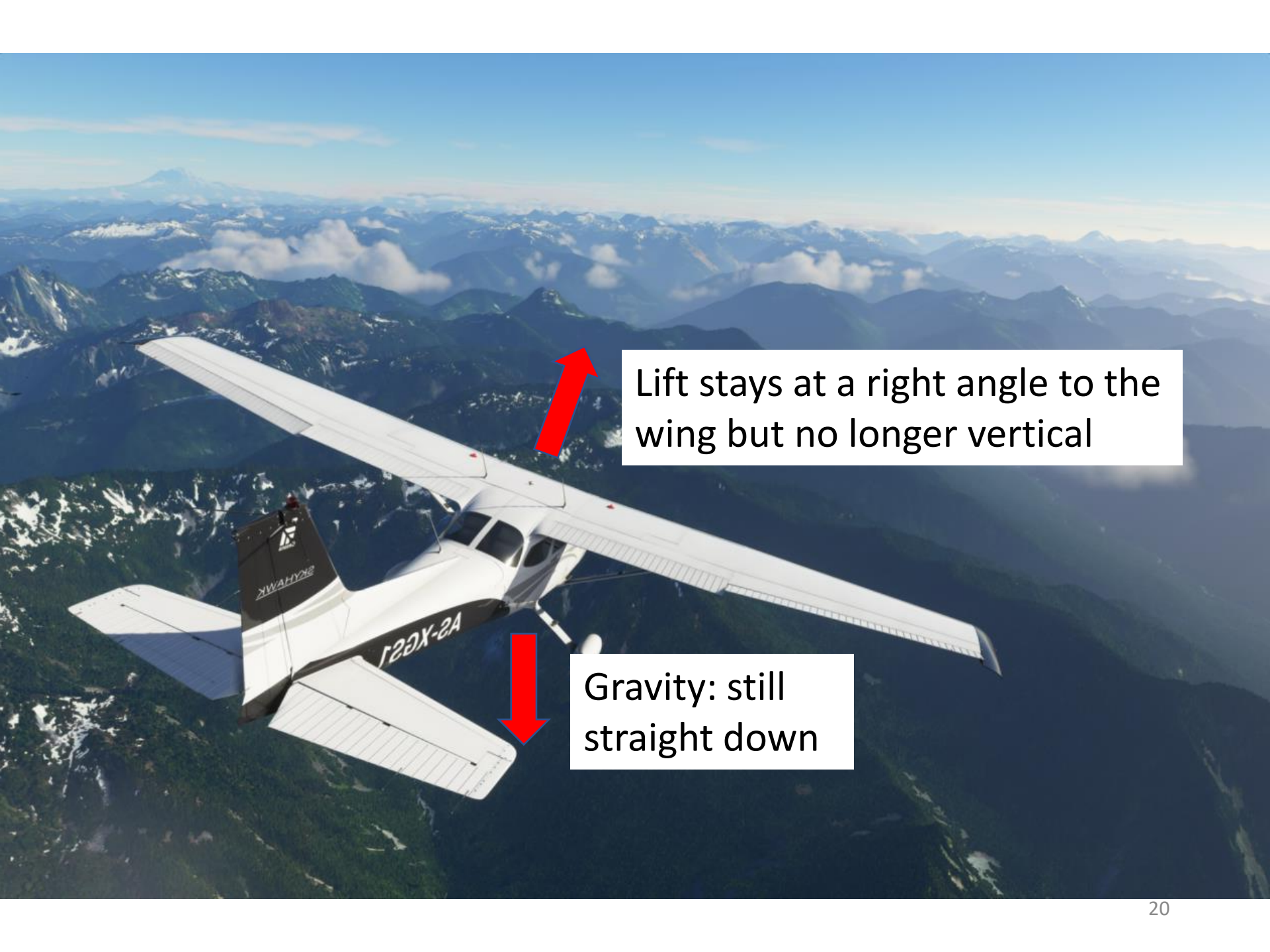


The rudder does not turn an airplane.



Lift: normal to the wing and vertical

Gravity: straight down



Lift stays at a right angle to the wing but no longer vertical

Gravity: still straight down

- The rudder is only there to compensate for the adverse yaw created by differential aileron deflection, to make the back end of the airplane follow the nose. It is NOT there to turn the airplane.
- Once a turn is stabilized, the rudder is essentially neutral.



Holding rudder in a turn

- Holdover from driving/boating
- Not the way an airplane turns



Holding rudder in a turn *is* necessary for boats, cars

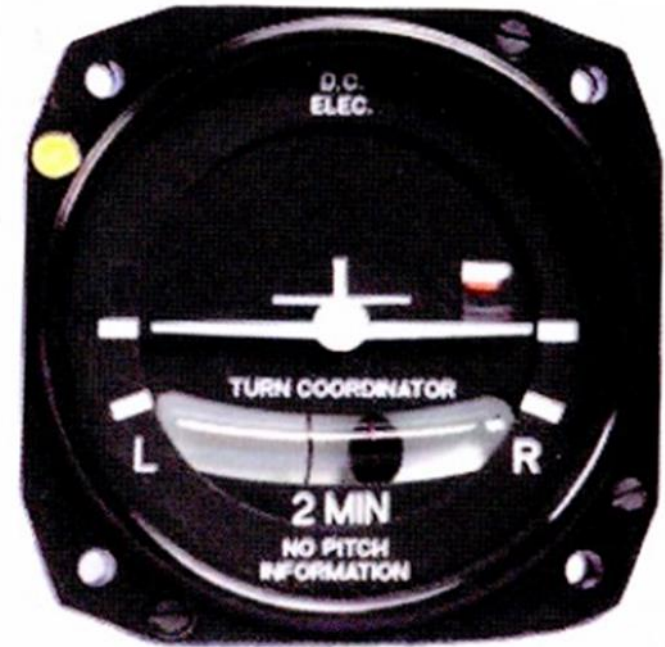
What happens if the pilot holds bottom rudder in a turn?

Skidding turn: turning right while holding right rudder
Usually with opposite stick/yoke to prevent overbanking



**Solution: *don't* step on the ball,
just release right rudder!**

Climbing straight with one wing low



An airplane turns left in a climb. Common but incorrect solution is to add right yoke.

Proper solution is to level the wings and add right rudder.

Pop Quiz: How do you trim an airplane?



How do you trim an airplane?

- Set power
- Hold desired attitude with stick/yoke pressure
- Trim off the pressure so it flies hands-free at that attitude.
- If you can take your hand off the yoke and the pitch does changes, you are NOT properly trimmed.



Discussion: How do you enter slow flight?



How do you enter slow flight?

- Have a target power setting, and a target pitch attitude, for different configurations



How do you enter slow flight?

- Have a target power setting, and a target pitch attitude, for different configurations
- ***Reduce power to the target setting, add carb heat***
 - ***Raise the nose to maintain altitude as the airplane decelerates***



How do you enter slow flight?

- Have a target power setting, and a target pitch attitude, for different configurations
- Reduce power to the target setting, add carb heat
 - Raise the nose to maintain altitude as the airplane decelerates
- ***Lower flaps when ASI is in the white arc.***
 - ***Lower the nose as flaps come down to maintain altitude as lift increases***



How do you enter slow flight?

- Have a target power setting, and a target pitch attitude, for different configurations
- Reduce power to the target setting, add carb heat
 - Raise the nose to maintain altitude as the airplane decelerates
- Lower flaps when ASI is in the white arc.
 - Lower the nose as flaps come down to maintain altitude as lift increases
- ***Add power to the target setting that maintains altitude***



How do you enter slow flight?

- Have a target power setting, and a target pitch attitude, for different configurations
- Reduce power to the target setting, add carb heat
 - Raise the nose to maintain altitude as the airplane decelerates
- Lower flaps when ASI is in the white arc.
 - Lower the nose as flaps come down to maintain altitude as lift increases
- Add power to the target setting that maintains altitude
- ***Add right rudder to maintain heading***



How do you enter slow flight?

- Have a target power setting, and a target pitch attitude, for different configurations
- Reduce power to the target setting, add carb heat
 - Raise the nose to maintain altitude as the airplane decelerates
- Lower flaps when ASI is in the white arc.
 - Lower the nose as flaps come down to maintain altitude as lift increases
- Add power to the target setting that maintains altitude
- Add right rudder to maintain heading
- ***Adjust pitch to maintain altitude***



How do you exit slow flight?

- Full power, turn off carb heat
 - Add right rudder if necessary
- Bring the yoke forward as airplane accelerates to avoid a climb
- Raise flaps in increments
 - Raise the nose as lift is lost to avoid descent
 - but then--
 - Lower the nose as airplane accelerates to avoid a climb
 - Reduce right rudder as pitch comes down, to maintain heading

PRACTICE!



The Canadian “Red Sparrows”

Maneuvers

With practice comes
awareness

With awareness comes skill

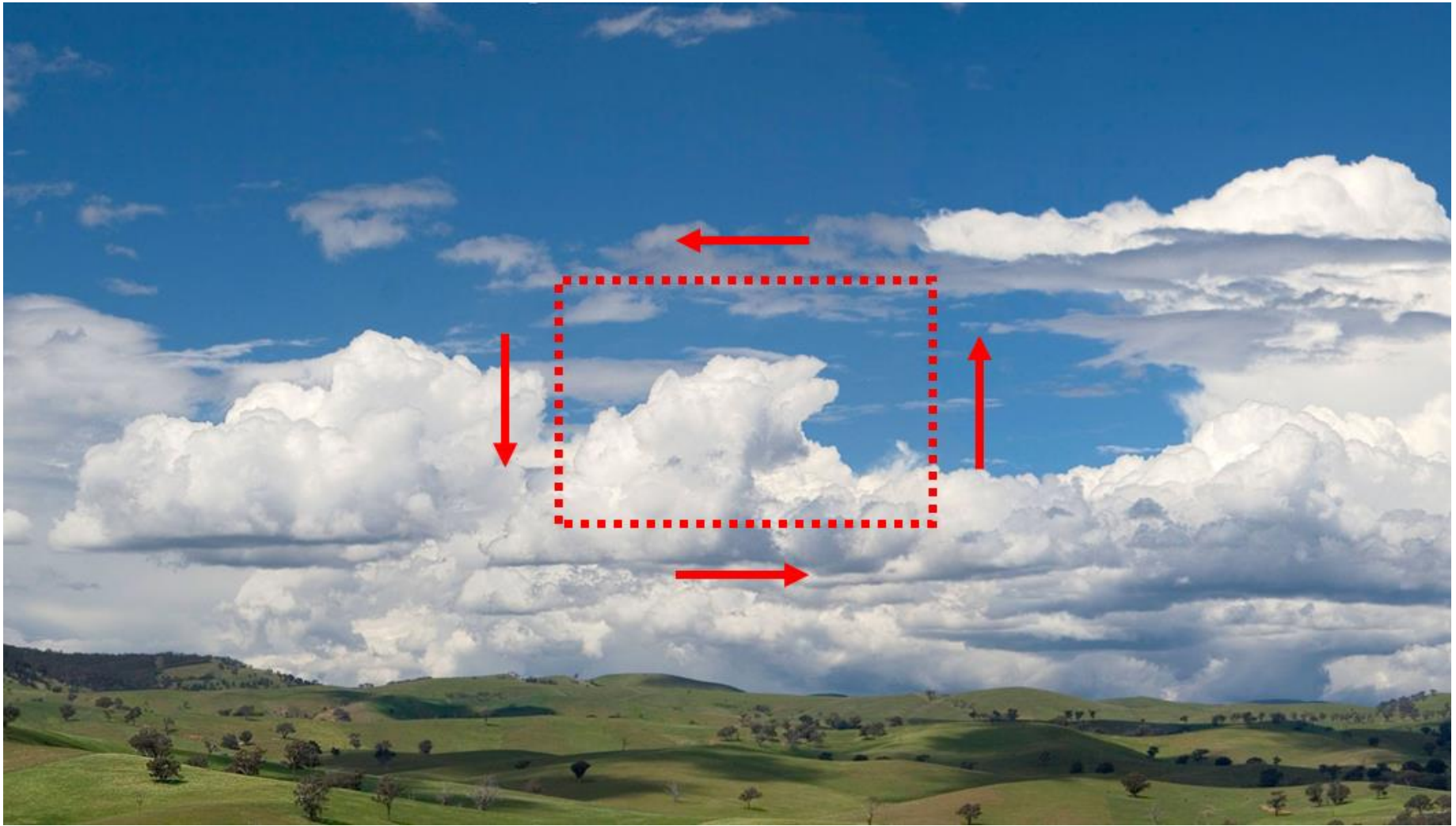


Stick and Rudder Maneuvers

- Individual control waggles descent
 - Level turns L&R, steep turns L&R
 - Slow flight
 - Slips L&R
 - Chandelles
 - Turns around a point road
 - Corkscrews
 - Crosswind takeoffs and landings
 - Stalls: full, imminent, wings level, banked, power on/off
 - Drawing squares around a mountaintop or cloud
- Trim: level, climb,
 - Climb/descending turns
 - Steep turns
 - Forward and side slips
 - Lazy 8s
 - S turns across a
 - Dutch rolls



Drawing squares around a mountaintop or cloud while maintaining a constant bank angle



**Clockwise, Counterclockwise, Large squares;
Small squares; Circles; Figure 8's**

Practicing S&R Maneuvers



- Use but do not depend on the slip-skid ball
 - Develop your “seat of the pants” *feel* for the airplane
- Practice until you can anticipate the needed control pressures without monitoring the ball.
- Practice solo, with a co-pilot, or with a CFI
- Developing precision, familiarity, and comfort

