

Turns - Ground Lesson

Objective

To understand the relationship between the yoke and the rudder pedals to perform proper turns.
To understand the forces on a plane in turns.

Schedule

Ground instruction – 10 minutes

Reference Material

FAA PHAK

https://en.wikipedia.org/wiki/Turn_and_slip_indicator

boldmethod.com

Why

Make a bad turn and you might cause a spin...and crash.

Material

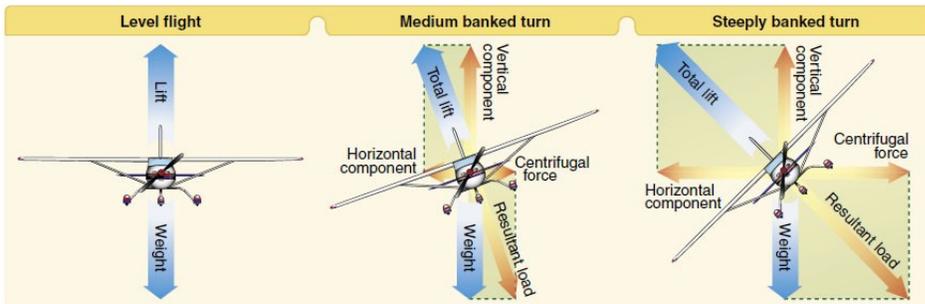


Figure 4-28. Forces during normal coordinated turn.

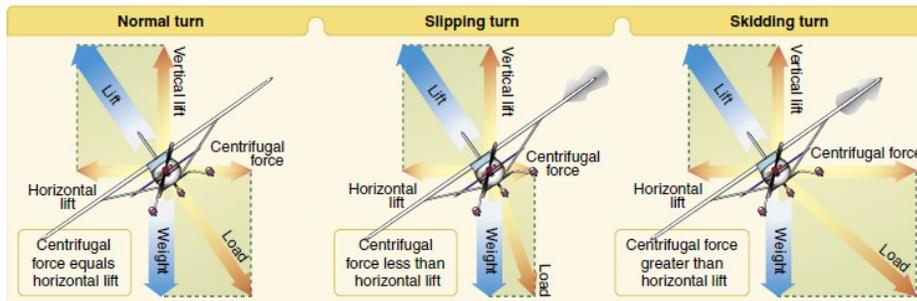


Figure 4-29. Normal, slipping, and skidding turns.

When airspeed is reduced, the vertical component of lift is reduced. To keep level flight you must either increase the angle of attack or reduce the angle of bank.

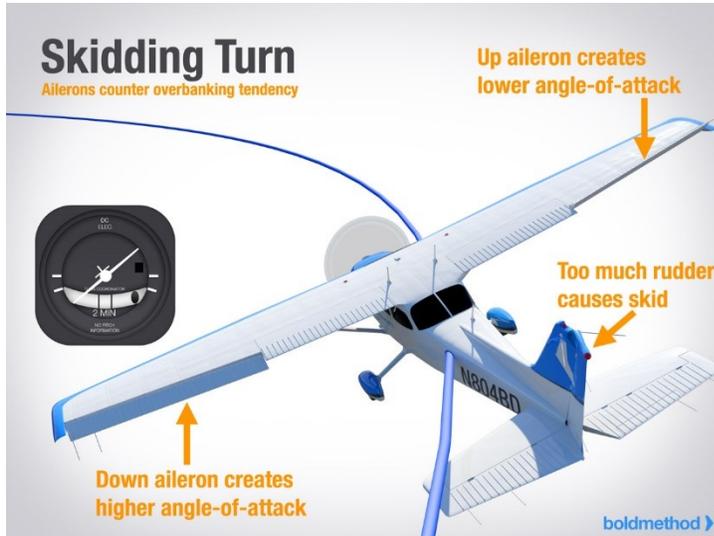
Turns - Ground Lesson

Skid

A skid has too much rudder used in the direction of bank.

Too much rudder

Centrifugal force > Horizontal lift



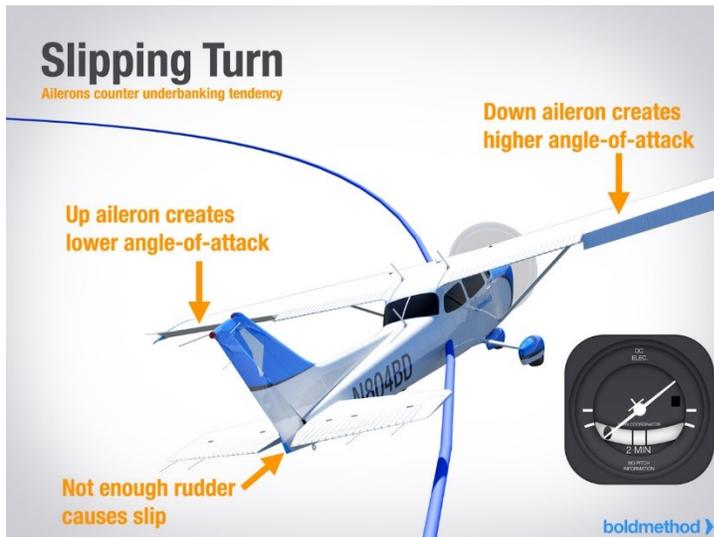
Slip

A slip does not have enough rudder, or more likely rudder opposite to the direction of the bank.

A slip is a turn that is stopped by use of the rudder.

Not enough rudder

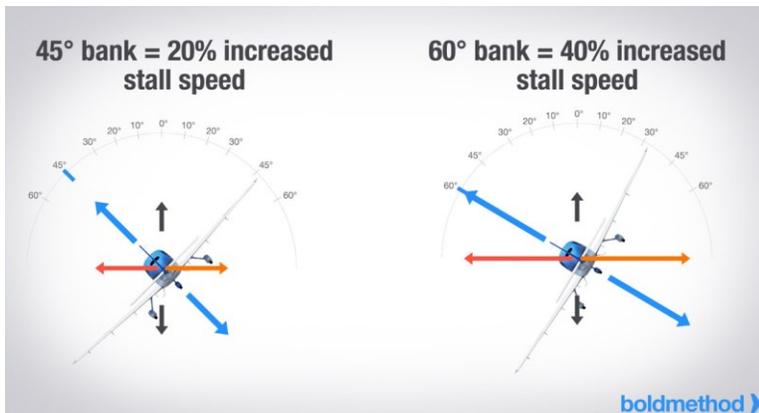
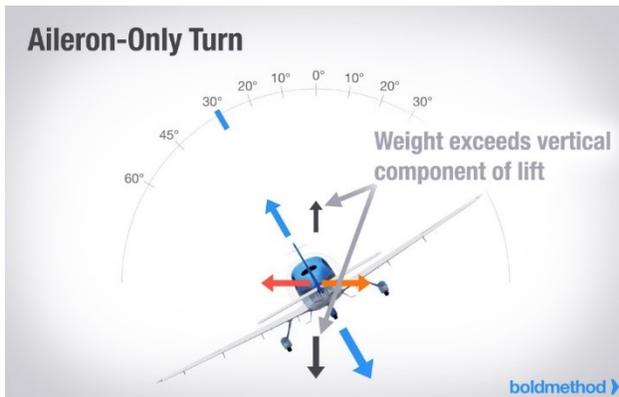
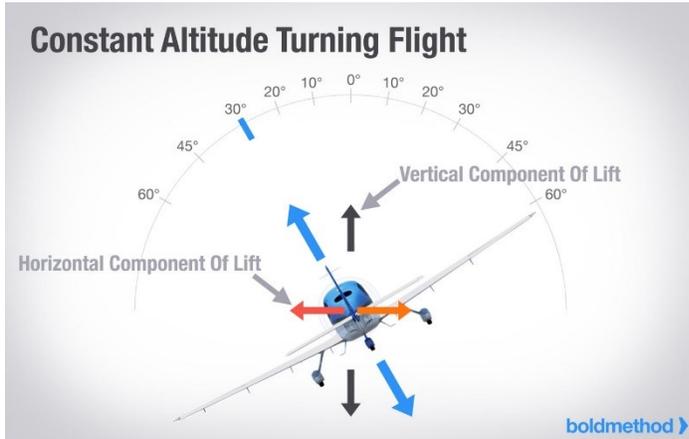
Centrifugal force < Horizontal lift



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Increased Loading

You're "loading the wing" as you increase back pressure to compensate for reduced vertical lift. There is a downside to increased loading though: your stall speed increases. As you increase your wing's angle-of-attack with back pressure, you start approaching your airplane's critical angle-of-attack and risk entering an accelerated stall. This is exactly why you were taught that your stall speed increases during a steep turn, for instance.



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Figure from Knowledge Tests



Figure 144. Turn-and-Slip Indicator.

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- 1 = Skid
- 2 = Slip
- 3 = Coordinated

Why Skids Are More Dangerous Than Slips

Stall-spin accidents have been a problem since the first days of flight. Most of us are simply taught to keep an aircraft coordinated when stalling. But, the problem is, most stall-spin accidents don't happen during an intentional stall. They usually happen unintentionally and down low - like when you're turning base to final.

Here's a common scenario: You're turning left base to final, but you're going to overshoot the runway. What do you do? Here's what you absolutely shouldn't do: You add left rudder to tighten the turn, but you don't keep the bank and rudder coordinated - putting the airplane into a skid.

What can happen next is pure disaster. The skid causes an over banking tendency, which you counter by adding opposite aileron (often subconsciously). That also pulls the nose down, which you oppose with elevator. Suddenly the aircraft stalls and snaps to the left in an incipient spin. At 700' AGL, you make it through about a turn before you crater into the ground.

If the airplane is slipping toward the inside of the turn at the time the stall occurs, it tends to roll rapidly toward the outside of the turn as the nose pitches down because the outside wing stalls before the inside wing. If the airplane is skidding toward the outside of the turn, it will have a tendency to roll to the inside of the turn because the inside wing stalls first.

You'll hear many people say you should limit your traffic pattern bank angle to 30 degrees, and others will say that's dangerous because it can lead to a skidding turn-to-final. The answer is really simple - don't use rudder to tighten a turn. Limit the bank angle if you want, but simply go-around if you can't make that turn from base to final. A go-around gives you the chance to set up again, and line up the landing like a pro.

Turns - Ground Lesson

Airspeed changes while turning

When airspeed is decreased in a turn, what must be done to maintain level flight?

When airspeed is reduced, the vertical component of lift is reduced. To keep level flight you must either increase the angle of attack or reduce the angle of bank.

Airspeed –

=> bank angle – or AOA +

Airspeed +

=> bank angle + or AOA –

If you turn without using rudders

If you turn right...

Plane goes right, Ball goes left

If you turn left...

Plane goes left, Ball goes right