XI.G. Spins

About: Aggravated stall that typically occurs from a full stall occurring with the airplane in a yawed state and results in the airplane following a downward corkscrew path.

Both wings are stalled in a spin, but one is more deeply stalled than the other. The "more stalled" wing is on the inside of the spin, it flies at a higher angle-of-attack, and it generates less lift than the outside wing.

TSW: Understand the reasons a spin can happen and how to prevent one. As long as coordination is maintained during a stall, a spin will not occur.

Procedure:

1. 1500 AGL for recovery 2x 90 degree clearing turns
2. Power Idle- carb heat on
3. Apply back pressure to maintain altitude: **Ailerons neutral**
4. Just prior to stall, **apply full rudder** in direction of intended spin
5. Continue to hold yoke back, neutral aileron, full rudder throughout spin

Recovery (PARE)

   a. ***Power:*** Idle
   b. ***Ailerons:*** Neutral
   c. ***Rudder:*** Opposite rotation
   d. ***Elevator:*** Forward to break stall
   e. Hold control inputs until rotation stops

6. **Neutralize rudder and level the wings** when rotation stops
7. **Apply back pressure** to recover from dive
8. As nose rises to horizon **add power, remove carb heat**

Discussion Points:

9. In a spin, the inside (lower wing) is more stalled than the outside wing, which creates an autorotation, or rolling, yawing, and pitching motion around the vertical axis of the aircraft
10. An airplane must be stalled and yawed in order to enter a spin.
11. Why do we nose down at the end of a spin recovery?
    a. Reduce angle of attack to break the spin
12. Ensure aircraft is approved for spins (POH) and loaded appropriately.
13. In some training airplanes the spin can transition unexpectedly from a spin to a spiral dive. In this case, the airplane will not be in equilibrium but instead be accelerating and G load can rapidly increase as a result.
    a. Power to idle, level wings, slowly pull back to nose-level attitude.
    b. Add power once you've recovered and your airspeed normalizes.

Phases of a Spin:

14. ***Entry:*** Pilot provides the necessary elements for the spin
15. ***Incipient:*** Occurs from the time the airplane stalls and starts rotating until the spin is fully developed (~2-4 turns).
    a. During this phase the aerodynamic and inertial forces have not achieved a balance
16. ***Developed:*** Angular rotation rate, airspeed, and vertical speed are stable and flightpath is near vertical. Thus, aerodynamic forces and inertial forces are in balance.
17. ***Recovery:*** Rotation ceases and AOA is decreased below the critical AOA

Common errors:

18. Failure to distinguish between a spiral dive and a spin. Not recognizing a high airspeed (increasing), high rate of descent (increasing, steep spiral condition; the nose of aircraft will not be as low in a steep spiral.
19. Excessive speed or accelerated stall during recovery.
    a. After spin recovery, being too cautious in pulling out of dive resulting in excessive airspeed.
    b. Applying too much back pressure when recovering, resulting in secondary stall.
20. Failure to recover with minimum loss of altitude.
    a. Not using correct recovery procedures.
    b. Hesitation in applying necessary control applications.

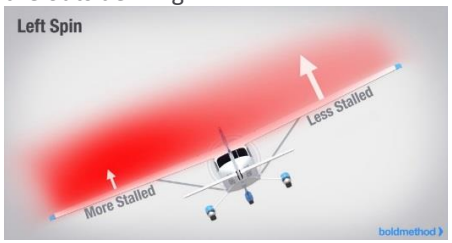
Evaluations/ Standards:

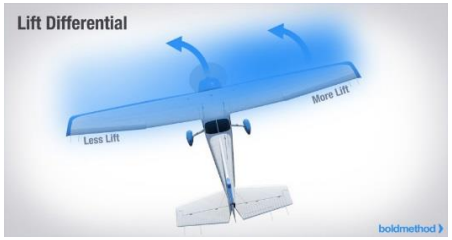
21. Demonstrate and simultaneously explain a spin (one turn) from an instructional standpoint
22. Analyze and correct simulated common errors related to spins
23. Spin Awareness: Exhibit knowledge of elements related to spin awareness by explaining:
    a. Flight situations where unintentional spins may occur
    b. Technique used to recognize and recover from unintentional spins
    c. Recommended spin recovery procedure for the airplane used for the practical test
    d. Aerodynamic factors, including instrument indications that occur in a spin
    e. Phases of a spin

First Off, What Exactly Is A Spin?

The FAA defines a spin as "an aggravated stall that results in an airplane descending in a helical, or corkscrew path."

Which brings us to spin point number one: both wings are stalled in a spin, **but one is more deeply stalled than the other.** The "more stalled" wing is on the inside of the spin, it flies at a higher angle-of-attack, and it generates less lift than the outside wing.





Since your high wing generates more lift than the low wing, it rolls your aircraft into the spin.

And at the same time, your low wing produces more drag, because it's at a higher angle-of-attack. And that drag causes your plane to yaw into the spin. When you combine both forces, you wind up in a fully-developed spin.

So How Do You Recover With "PARE"?

Spin recovery is pretty simple: break the stall on both your wings. When you do, your plane with fly itself out of the spin.

Step 1) P: Power To Idle

The first step in spin recovery is reducing your throttle to idle. But why would you take power out when you're already stalled?

In a normal stall, you add power to recover, but it a spin, adding power makes recovering more difficult. And it has everything to do with your aircraft's tail.

When you're at a high power setting, airflow from your propeller strike your horizontal stabilizer, causing a tail-down force and pitching your nose up. On top of that, if your center of thrust is lower than your center of gravity, it creates torque that pitches your nose up even further.

When you take the power out, you eliminate both of these factors, making it easier to get the nose down and fly out of the spin.

Step 2) A: Ailerons Neutral

When you bring your ailerons to neutral, you help your wings reach the same angle-of-attack, which helps you reduce the rolling and yawing moments in the spin.

If you try to raise your inside wing using ailerons, you'll actually make the spin worse, because you increase the angle-of-attack of the inner wing. And what about rolling your ailerons into the spin? That's not a good idea either, because as you start to recover, your outside wing is at a higher angle-of-attack, and you can inadvertently start spinning in the opposite direction during recovery.

Step 3) R: Rudder Opposite Spin

The next step is one of the most important ones: rudder. If you're spinning to the left, you add right rudder. And if you're spinning right? Add left rudder. When you add opposite rudder, you stop the rolling and yawing moment of the spin.

Step 4) E: Elevator Forward

And for the last step...breaking the stall. Once you have your plane configured to fly out of the spin (steps 1-3), it's time to reduce your angle-of-attack and keep on flying.

By quickly moving the control yoke forward, you get yourself back under the critical angle-of-attack, and you un-stall your wings. One of the hardest parts of this step is that you feel like you're going almost straight down in a spin, and it doesn't feel natural to push forward on the yoke. But it's the best (and only) way to break your stall quickly and get back to straight-and-level flight.

Finish Your Spin Recovery

Once you've completed these 4 steps, your plane will fly itself out of the spin. When it does, bring your rudder to neutral, and raise the nose, and slowly add power to get as you get back to level flight.

Most training aircraft exit a spin very quickly, but you should always use your aircraft's POH, and remember, have your spin recovery checklist memorized. After all, it's pretty hard to read a checklist during a spin.