Flat Spins

From: http://myflyingstuff.com/flat-spins/

UPRIGHT SPINS vs FLAT SPINS

Was recently asked by a private pilot student about the difference between a typical upright spin and a flat spin and how do you recover from a flat spin? Although I have done a reasonable amount of spins, I can't say that I have had the pleasure of a flat spin, nor do I think I want to. Since I am not degreed in aerodynamics or an aeronautical engineer, had to do a bit of reasearch. Here is some general information I have pieced together.

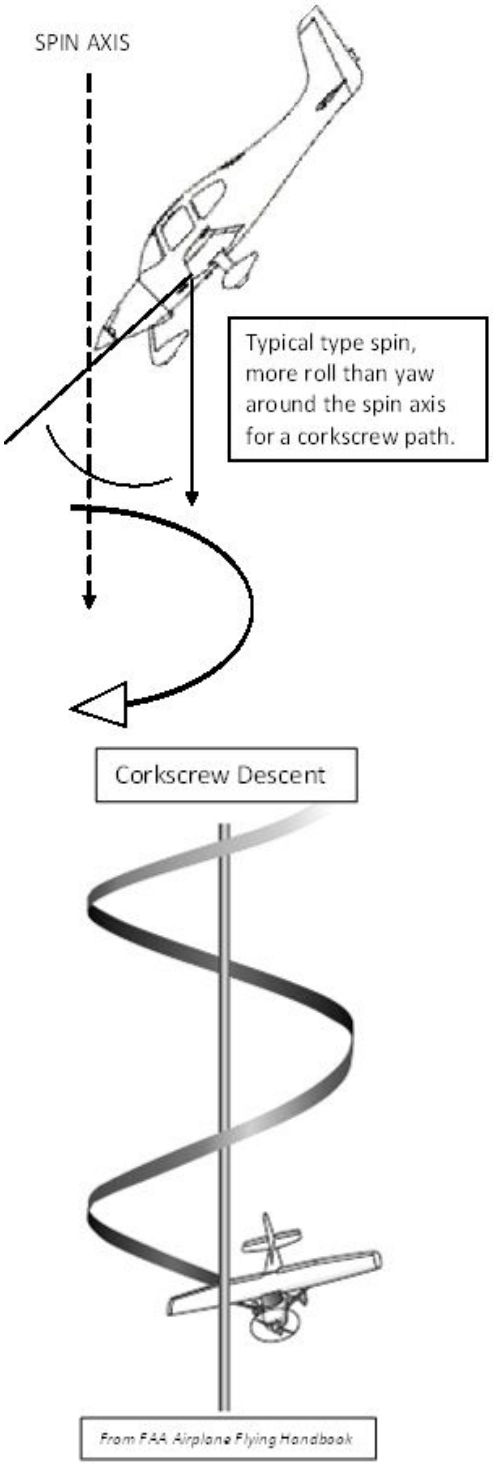
Most "Normal Category" airplanes that we all usually fly are not certified by the FAA to do intentional spins. They do, however, need to have spin testing done prior to certification. The FAA says in AC23-8D Section 23.221 that the basic objective of Normal category spin testing is to assure that the airplane will "not" become uncontrollable within one turn (or three seconds, whichever takes longer). For the Utility Category aircraft, it is the same as normal category, but can additionally be certified for spins if aerobatic spin requirements can be demonstrated. The Aerobatic category requires demonstration of six turns (or more) with recovery accomplished in 1.5 turns after anti-spin recovery controls are applied. There are no certification requirements for twin engine aircraft.

To refresh, the characteristics of an upright spin are:
-A sustained stall (Rectangular wings usually stall around 18°)
-Asymmetric lift, drag on the wings where one wing is higher inducing a rolling and yawing motion.
-Aircraft CG travels down along a helical (corkscrew) path.

Now to the differences in spins:

UPRIGHT SPIN (Moderate to Steep Spin)

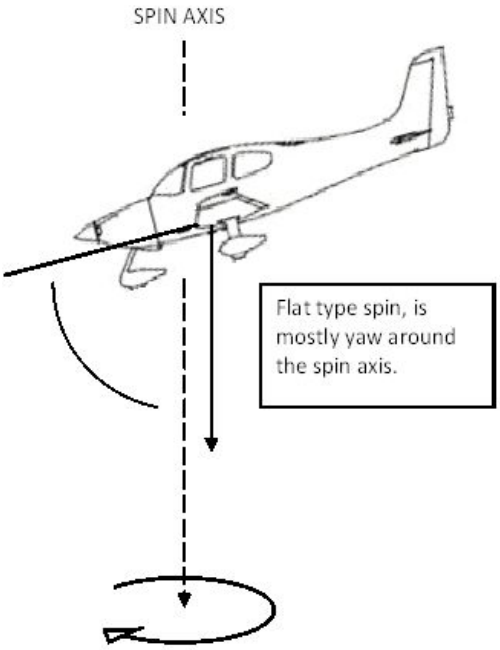
A typical spin is stalled wings with nose pitched down and "rolling" to right or left. Some yaw but to a lesser degree. In a moderate to steep nose down spin there will be some rudder and elevator authority. We use the recommended spin recovery technique listed in the POH which is usually similar to P.A.R.E.D. or Power to Idle – Ailerons Neutral (flaps up) – Rudder Opposite of Spin – Elevator Forward to reduce angle of attack – Recover from Dive. When rotation stops, rudder to neutral then add back pressure on the elevator and return to level or climbing flight.



FLAT SPIN

In the flat spin, the nose is pitched up to a more horizontal attitude, the CG is closer to the spin axis, the rotation is faster with a slower descent, the helical corkscrew pattern is more compressed and there is mostly yaw with little roll. This means the rudder and elevator are moving sideways through the air instead of forward, thus making them ineffective. Plus the wings are stalled causing minimal aileron control. In discussing the flat spin with an accomplished aerobatics pilot, they enter the spin and maintain power on with a normal CG. The rotation is caused largely by the engine torque and the more level attitude (to the

horizon) with the power on situation. When the aerobatic pilot pulls power off, the nose will drop and rudder can be applied to stop rotation and recover. Should the CG be too far aft, it may be unrecoverable. Unfortunately it seems that many aircraft have been unable to recover from a flat spin. This could be caused by one or a combination of factors: an aft CG, the pilot not pulling power to idle or some aspect of the design/manufacture. I did hear of one pilot who released his seat belt and moved enough forward (in this instance) to change the CG and gain sufficient effectiveness in the control surfaces to recover.



Side note:
NASA recommends various tail configurations and other strategies to eliminate the flatter of the two spin modes and make recovery from the steeper mode more reliable.

NASA Spin Mode Classification

Spin mode	Angle-of-attack range, degrees
Flat	65 to 90
Moderately flat	45 to 65
Moderately steep	30 to 45
Steep	20 to 30

As was stated earlier, the Normal category aircraft does not need to be tested beyond being controllable after one (1) turn or three (3) seconds whichever comes first. From that point on, you really cannot be certain if the plane will advance into a typical upright spin or a flat spin.

How to avoid a flat spin? Always carefully plan your aircraft weight and balance before each flight to avoid overloading or unusual CG's that could contribute to all sorts of controllability issues. And, probably the best avoidance solution would be to get with a

qualified instructor and a spin certified aircraft. Then go out and learn how to recognize (and recover from just in case) imminent stall/spins. It is also important to note that a large number of stall/spin accidents occur in the airport traffic pattern where you are low and slow making turns…..

Here's some excellent Do's and Don'ts from AOPA's Aviation Safety Institute and their page on spins.

Do remember that since the majority of fatal stall/spin accidents occur at low altitudes, from which recovery is unlikely, *prevention* essential.

Do practice stalls or approaches to stalls at an appropriate and safe altitude and only when you are competent. If it's been awhile, take an experienced CFI with you.

Do practice spins only with an instructor who is current and only in a properly maintained *and* approved aircraft. In some cases a parachute may be required.

Do fly at a safe altitude above the ground so that you won't be surprised by terrain, wires, or towers that would require a quick pull up and a probable stall.

Do remember that turns, vertical (pull ups) or horizontal, load the wings and will increase the stall speed, sometimes dramatically.

Don't explore the corners of the flight envelope close to the ground.

Don't exceed 30 degrees of bank in the traffic pattern.

Don't follow another aircraft in the pattern too closely. If you cannot maintain a safe airspeed (safe AOA) – go around.

Don't buzz or otherwise show off with any aircraft. You don't need to – as a pilot you belong to a special group – less than one third of one percent of the U.S. adult population is certificated to fly.