Spins

By Bob Wander

Over decades of instruction I have discovered that very few pilots can answer all three questions that follow. Please write down your plain-English answer to each of the three questions below. Limit yourself to 50 words or less for each answer, please!
Question # 1: When the spin begins, why does the glider nose pitch down?
Question # 2: When the spin begins, why does the glider bank to the left or to the right?
Question # 3: When the spin begins, why does the glider yaw develop into continuing rotation?
(You'll get greatest benefit from reading this article if you write down your answers right now, before reading further.)

Answers:

1. The nose pitches down because the spin is a variety of stall. In a properly loaded glider, the nose-down tendency at the stall occurs because the Center of Gravity (CG) is forward of the center of lift on the wing.
2. The glider banks left or right because one wing is more stalled than the other wing. The glider banks toward the more deeply stalled wing because it produces less lift than the other wing.
3. A spinning glider auto-rotates (spins) because the more stalled wing produces more induced drag (rearward acting force on the wing) than the less-stalled wing. Auto-rotation usually continues until this drag inequality is eliminated.

How did you do? Many pilots get # 1 right; some pilots get # 2 right; and very few pilots get # 3 right. So read on please!

The Fatal Stall/Spin Accident Scenario
Imagine a glider in the following flight condition: A shallow bank (15 degrees or so), slow-flight turn to the left, with excess left rudder applied. Let's analyze any stall-spin risk factors that are present. We'll call each stall/spin risk factor a Strike (like in baseball).

During turning flight, the inner/lower wing has a higher Angle Of Attack (AOA) than the outer/upper wing. In a shallow bank turn to the left, the left wing is flying at higher AOA than the right wing because the curved flight path results in reduced forward-speed vector at the left wingtip and increased forward-speed vector at the right wingtip. That's Strike One.

During shallow bank, slow-flight turns, the glider's over-banking tendency is pronounced. To counter the over-banking tendency, the pilot puts the stick to the high side of the cabin. In a shallow bank turn to the left, this lowers the aileron on the left wing (increasing the AOA of the left wingtip/aileron combination) and raises the aileron on the right wing (decreasing the AOA of the right wingtip/aileron combination). That's Strike Two.

Skidding the turn (applying excess rudder in the direction of the turn) increases the AOA

of the inner/lower wingtip because it reduces the forward speed vector in the inner/lower wingtip, and reduces the AOA of the outer/upper wingtip because it increases the forward speed vector of the outer/upper wingtip. And that's Strike Three.
For these three reasons, during a slow-flight, shallow bank skidding turn, the inner/lower wingtip is at higher angle of attack than the outer/upper wingtip. Each factor, by itself, invites a stall of the inner/lower wing. When the three factors gang together as described above, they make a stall of the inner/lower wing almost unavoidable. Three Strikes... Stall/Spin You're O-U-T.

Factors That Contribute To Inadvertent Landing-Approach Spins

- Delayed/low altitude entry into the landing pattern, leaving insufficient time to evaluate all conditions and plan a suitable approach to landing
- Hugely mistaken belief that applying back-pressure on the stick will make the glider hold altitude and keep you safe
- Distraction from the fundamental business of FLYING THE GLIDER (resulting in poor airspeed control and poor turn coordination)
- Unexpected developments such as strong wind or heavy sink
- Lack of training in spin recognition skills and spin recovery skills.

Spin Training Methods
Spin training method # 1: Performed from a straight (not turning) flight path. With the wings level, haul back, raise the nose WAY above the horizon, and then boot the rudder hard over to induce a spin. In the old days, a pilot candidate was expected to perform three complete turns, then recover from the spin and roll out to wings-level flight on a pre-selected heading. So what's the problem with this training? Well, pilots trained solely by this method generally conclude that all spins are preceded by extreme nose-high pitch attitude and that assumption is both wrong and dangerous.

Spin training method # 2. The spin warning signs and the incipient spin are elicited from turning flight with a shallow bank, skidding turn, nose-on-the-horizon entry to the spin. Performed at safe altitude, training in this type of spin entry simulates the inadvertent, skidding turn, low-altitude traffic pattern spin entry that, when it occurs, usually kills someone. Unfortunately, few pilots receive accident-prevention spin training in recognizing this type of spin entry! When intelligently conducted, this type of spin training has the following characteristics:

- Spin training is provided by a CFI-Glider with experience in providing spin instruction, is always preceded by clearing turns, and is always conducted at safe altitude and in airspace that is appropriate for spin training
- Training emphasizes the warning signs that a spin is about to occur
- Flight control inputs to elicit the spin are gradual and gentle, rather than abrupt
- Entry to the spin results from a shallow bank, skidding turn, with nose on or just below the horizon
- Training emphasizes immediate and correct application of the flight controls to exit from the incipient spin with minimum altitude loss. The moment that rotation tries to begin, it is arrested.

The advantages of this type of spin training include:

- Realistic simulation (at safe altitude) of the type of spin entry that claims lives
- Spin entry occurs from relatively flat pitch attitude, rather than from extreme nose-high pitch attitude
- Cross control of ailerons and rudder is applied gradually, not abruptly
- Provides accident-prevention spin training because it simulates the type of inadvertent, dangerous spin (entered from turning flight) that must be avoided during the approach to landing.

Preventing Inadvertent Spins

Prevention is simple, really. Exercise the self-discipline to arrive in the vicinity of your intended landing area with plenty of altitude and time to plan, and then fly, the landing approach with appropriate airspeed and well-coordinated turns. Anticipate environmental variables such as wind shear, heavy sink, or conflicting traffic. Maintain, through recurrent training, familiarity with the warning signs of approaching stall or stall/spin.

You can seek out spin training during primary flight training (e.g. before first solo in glider); during recurrent training (such as Flight Reviews and other recurrent training - seasonal checkouts and so on); and in fact ANY TIME you can fly with a spin-qualified CFI-Glider!

To view an illustrated PowerPoint-style presentation on spins, please log on to the SSF website at www.soaringsafety.org and click on 'Presentations', then click 'FIRC', then click 'Spins'.