



Rich Stowell, MCFI-A

**P**art 1 in the Primary Smooth miniseries proved just how accessible and fulfilling this achievement award can be. High-end aerobatic airplanes and lots of flying experience are not necessary. All that's required is a commitment to learn four maneuvers to standards set forth in the IAC Official Contest Rules. We've previously discussed precision and discipline as they relate to competition aerobatics. These two mainstays will take on even more significance now. Our maneuvers, for instance, will soon be judged on the precision of specific lines, angles, and headings. Consistency of roll rates will be an issue now, too.

As for discipline, each of the maneuvers requires focusing on the correct control inputs at the appropriate times. An odd new discipline must be developed as well: not correcting errors. This is completely contrary to everything pilots have been taught to do in an airplane, but once a deviation has occurred during the execution of one of these maneuvers, you shouldn't fix it. Acquiring this peculiar form of self-control offers several advantages. When practicing, for example, not automatically fixing a deviation allows you to see exactly how far off you were from the target line, angle, or heading. With this valuable information you can diagnose why the error occurred in the first place and adjust accordingly during the next attempt. Overall precision will improve as a result. When being judged, correcting a mistake telegraphs exactly how far off you were, showing the judge precisely how many points to subtract from your score. Although judges generally are nice folks, it's in their job description to take points away from you for every little fault. Don't make their job easier by revealing the full extent of your errors!

### Getting to Work on the First Two Maneuvers

#### Maneuver 1: The Turn

The rules insist that banking and turning actions be distinctly separate from each other. The bank angle must be at least 60 degrees and must remain constant once it has been set. Roll rates shouldn't vary when banking into and out of the turn. Altitude and turn rate must not fluctuate. And the turn must end precisely 270 degrees from the starting heading. Deviations from these standards will result in your score being downgraded.

The turn happens to be the only maneuver where the pilot has discretion when setting an angle. Angles in other judged maneuvers are clearly specified: Vertical lines must be vertical, 45-degree lines must be 45 degrees, and point rolls must hit their target bank angles. But as long as the minimum requirement of 60 degrees is met, you have some leeway when choosing the bank angle for your turn. This might seem to be to your benefit, but it really is not. Rule writers and judges are hoping you'll take the bait and crank the airplane into the steepest turn possible. Don't fall for this trap! More is not better. You don't get any extra credit for exceeding 60 degrees; however, your workload and the potential for botching the turn will rise exponentially with increasing bank angle.

Instead, let's calibrate ourselves to the bank angle that requires a steady 2-1/2g pull to sustain level flight. You'll be banked about 66 degrees in this case—10 percent beyond the qualifying angle, clearly satisfying the criterion.

The sequence of control movements for the entire maneuver goes like this: Roll. Stop! Turn. Stop! Roll. Stop! The maneuver has two key reference points. One is the starting heading; the other is the exit heading. For a left turn, select the exit point by sighting down the right wing before you start and vice versa for a right turn.

"Roll" means apply coordinated aileron and rudder inputs. Start the maneuver with smooth but crisp control actions—left aileron and left rudder, or right aileron and



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right rudder. Likewise, finish the maneuver on your exit point with equally crisp aileron and rudder movements. Don't be shy here. We want the rolling to be obvious; thus, make the entry and exit bank changes as rapidly as possible. Focus on the aileron input, however, even though rudder is also being applied.

"Stop" means to instantly release the applied input(s). At the start of the maneuver, for example, snap both the aileron and rudder to neutral the instant you hit the target bank angle. Upon reaching the exit heading later in the turn, unload the back elevator pressure all at once to glue the nose of the airplane to your reference point. And upon returning to wings-level flight at the end of the maneuver, be sure to snap the aileron and rudder to neutral again. The stops in the turn sequence provide obvious separation between the other actions. In fact, pausing for a beat before applying the next action makes for a snappier presentation.





Sight picture as a Decathlon approaches 60 degrees of bank.

“Turn” means pull the nose around the horizon to the exit heading. Initiate the heading change with a smooth but positive pull straight back on the stick/yoke. Watch the nose of the airplane traverse the horizon as 2-1/2g continuously presses you into your seat.

Be on the lookout for these problem areas: dragging the inside rudder during the turn; leaning your upper body away from the turn; allowing the bank to increase during the turn; not getting a clean, distinct stop between roll and turn inputs; reverting to the normal flying habit of rolling out of the turn without first pushing forward to stop on heading; and underutilizing the aileron and/or rudder when rolling out.

#### Maneuver 2: The Spin

The rules require that spin entry occur from level flight, and the entry must

be characterized by a perceptible, nose-down pitch change. Rotation must stop precisely on the starting heading as well. Upon exiting the spin, a vertical line of perceptible length must be established prior to returning to level flight. Deviations, of course, will be downgraded.

Last year we devoted an entire article not only to the mechanics of the normal, upright spin, but also to the visual, discipline, and precision aspects (see “Normal Upright Spins,” *Sport Aerobatics*, April 2007). We’ll recap key points from that article as we proceed, but the caveats and warnings made then apply equally now. We’ll modify our entry and exit to satisfy the judging criteria as well. Even so, the basic sequencing of rudder and elevator movements remains the same.

Similar to the turn, recall that our one-turn spin has two key ground

references—the first one representing the entry/exit heading and the other representing the lead point where we’ll apply opposite rudder. The lead point varies depending on the airplane and how it’s loaded. For example, opposite rudder could be needed as early as 180 degrees prior to the exit heading in a Zlin 242L, or 90 degrees ahead in a Decathlon, or just 20-odd degrees ahead in an Aerobat. Be sure to choose your key points before every spin. The lead point in particular should be a prominent ground object very close to the airplane.

With the power idle and the ailerons neutral, you’ve now got three things to do: (1) hold altitude, (2) bleed off airspeed, and (3) stay on heading with the wings level. You must be proactive with the elevator and rudder without hurrying. Move the elevator control progressively aft while ever so lightly wiggling the rudder to keep the wings level and the nose perfectly on heading. It’s important to point out that spin entry “from level flight” does not mean from a level pitch attitude. The pitch attitude has to change as you decelerate toward the wings-level stall.

We have to enter our achievement award spin at the stall break. Hence, the instant the nose of the airplane pitches downward, briskly and fully push the rudder pedal to the firewall. Immediately pin the elevator control against its aft stop, too, and hold these control positions firmly in place. Keep your head locked forward. Project your vision beyond the nose to the ground below and expect to see your lead point twist into view.

Just as the nose slashes through the lead point, promptly swing the rudder fully opposite and hold it. Don’t move the elevator control. Keep the stick/yoke firmly aft until the nose reaches the exit heading. The judging criteria permit us to stop the spin and establish the vertical downline as two separate actions. However, we’ll combine this into one action for several reasons, including:

1. The transition from spin to downline shows better.
2. As soon as the spin stops, airspeed, trim pressure, and the

airplane’s natural tendency to seek level flight all increase. Consequently, delay or tentativeness in the push makes it more difficult to lock onto the vertical downline. The potential is greater as well for losing more altitude and attaining higher exit speeds and g-loads.

3. We’re making it easier for the judge to see where the downline actually begins. (That’s a good thing.)

Remember, you’re still holding full opposite rudder. The moment the nose hits the exit heading, your brain must now command your body to move the stick/yoke to the vertical downline position. The elevator input during a normal spin recovery typically ranges from minimal forward displacement to as far forward as the neutral position. The attitude during a normal recovery is also on the order of 60 to 70 degrees nose-down. In this spin, though, we’re not only moving the elevator control to terminate rotation, but also to increase our nose-down attitude another 20 to 30 degrees. You must move the stick/yoke from its full aft position to a spot somewhere forward of neutral. And you must accomplish this feat in the blink of an eye.

Later in your aerobatic career, you might learn to steal a quick glance down the wing as a self-check of the downline’s verticality. But for the Primary award, we’ll establish the vertical by learning precise elevator control placement. You definitely won’t be pushing the stick/yoke all the way forward here. Nevertheless, you should feel yourself lift out of your seat a little when you’ve reached the correct location. If not, you’ll be short of the vertical. This is where dual comes in as your instructor can help you zero in on the vertical down control position. Repeated practice then develops the muscle memory to hit that mark consistently.

Recall from the normal spin that once rotation stops we must actively neutralize the rudder to prevent the nose from swinging off heading. The same applies when exiting the Primary Smooth spin, except now we need to neutralize the rudder as (or just before) the elevator control reaches the vertical down position. Positively move the rudder to neutral and

## Primary Smooth Turn

**TURN ENTRY:** With the area clear & reference points chosen:  
**Roll.** Crisply apply aileron and coordinating rudder to roll to about 66 degrees of bank.  
**Stop.** Snap the aileron and rudder back to neutral.  
**Turn.** Smoothly pull 2-1/2g all the way to the exit heading.

### TURN EXIT:

**Stop.** Push forward to lock the nose onto your exit point.  
**Roll.** Crisply apply aileron and coordinating rudder to level the wings.  
**Stop.** Snap the aileron and rudder back to neutral.

Rule writers and judges are hoping you’ll take the bait and crank the airplane into the steepest turn possible. Don’t fall for this trap! More is not better.



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The normal spin recovery attitude can be quite shallow; push to establish the required vertical downline after the spin.

prevent the nose from yawing off heading as the airplane accelerates on the downline. The moment you're stabilized on the downline, count "one-one thousand, two-one thousand" to draw the line, then pull smoothly to level flight.

Be on the lookout for these problem areas: climbing or sinking prior to spin entry; too much delay between sensing the stall break and applying spin entry inputs; moving your head or leaning your body during the spin; correcting to the exit heading with ailerons; neutralizing the opposite rudder too soon, or forgetting to neutralize it altogether when setting the downline; consistently being short of the vertical (judge's parlance: "positive down"); and rushing to level flight/forgetting to count during the downline.

As always, get some instruction before attempting these maneuvers on your own, especially since we've modified the normal spin to meet judging standards. Visualize the steps in each maneuver before taking to the air. It's not a bad idea to take along an annotated sequence card on your flights either. Clear the area and choose your reference points before starting each maneuver. Practice your turns and spins in both directions and give yourself plenty of altitude to work with.

We'll map out the remaining Primary Smooth maneuvers next time. 

Rich Stowell is a Master Instructor-Aerobatics and author of *The Light Airplane Pilot's Guide to Stall/Spin Awareness*. E-mail your thoughts and ideas to [rich@richstowell.com](mailto:rich@richstowell.com).

## Primary Smooth Spin

**Pre-Spin** (area clear and reference points chosen):

- Power idle.
- Ailerons neutral.
- Hold altitude, heading, and wings-level; steadily pull to the stall.

**Spin Entry** (instant the nose pitches downward):

- Rudder briskly full in.
- Elevator rapidly full aft.
- Hold these inputs!

**Spin Exit** (at the lead point):

- Rudder briskly full opposite and hold.
- Elevator continue to hold full aft.

**On the Exit Heading:**

- Elevator straight forward to the vertical down position.
- Rudder actively neutralized.

**Post-Spin:**

- Downline, count "one-one thousand, two-one thousand."
- Smoothly pull about 3g to level flight.
- Stop. Push to set level flight, add power.

Just as the nose slashes through the lead point, promptly swing the rudder fully opposite and hold it.

