

recreational aerobatics: Uncoordinated Flight

By Rich Stowell, MCFI-A

"You know the nearer your destination, the more you're slip slidin' away!"

—Paul Simon



In the December 2006 issue of Sport Aerobatics, Rich Stowell provided an excellent article titled **Putting It Together**. That article reminded us that, as certificated pilots, we are already flying sequences. He wrote, "The ability to string together a series of individual maneuvers into a well-executed sequence surely represents one of the ultimate expressions of piloting skill. Of course, "flying sequences" is a familiar concept to air show and competition pilots. But all pilots—aerobatic or not—are taught a number of useful sequences during flight training. For example, not only is the traffic pattern among the earliest sequences pilots learn, it is also the most common sequence we fly."

This month, Rich helps us understand that controlled uncoordinated flight requires the same skill and finesse as coordinated flight. Once again, we'll learn that taking the skills we already have and applying them in new ways makes us become better and safer pilots.

What better way to ring in the new year than by practicing some intentional uncoordinated flight? Let's take a moment to distinguish between coordinated flight and coordinated inputs first. Coordinated *flight* occurs whenever we proactively cancel the adverse yaw effects associated with power (engine/propeller effects), aileron inputs, and airplane rigging. Otherwise, we would experience uncoordinated flight, which is what we'll explore in this article. Note that this is different from coordinated *inputs*, which simply means that our control movements are applied in concert. For instance, we coordinate aileron and rudder inputs when rolling into a coordinated turn. We should likewise coordinate aileron and rudder inputs when establishing a slip. In the former case, we remain in coordinated flight throughout; in the latter case, we intentionally cross-control our inputs for uncoordinated flight.

Uncoordinated flight comes in two basic flavors: skid and slip. For our purposes, skidding occurs when the deflected rudder points earthward. Slipping occurs when the airplane is stabilized in cross-controlled flight with the deflected rudder pointing skyward.

Skidding, as loosely defined above, has very limited utility. We normally avoid skidding at all costs, especially when in the traffic pattern. However, we can use an intentional skid to accomplish two specific maneuvers: an aggravated stall/spin entry from turning flight, and the pivot at the top of a hammerhead. Intentional spins will be discussed in the next installment of "Recreational Aerobatics." Suffice it to say that, unless you intend either to spin or to hammerhead, don't ever point the rudder toward the ground in uncoordinated flight!

Compared to skidding, slipping offers a variety of practical and beneficial uses. For example, we can slip to:

- Lose excess altitude on final approach
- Improve forward visibility in blind airplanes, such as the Pitts, Great Lakes, and Stearman
- Cancel crosswind effects during landing

- Regain command of the airplane should we encounter a jammed aileron or rudder control
- Counteract a split flap or an asymmetric thrust scenario in a twin-engine airplane

We'll focus on slipping in the rest of this article. However, a few words of caution before we go any further: *The layout of fuel systems in some airplanes can result in fuel starvation during prolonged slips, especially in low-wing aircraft feeding from wing tanks.* The A36 Bonanza, for example, places a 20- to 30-second time limit on continuous slipping; in some instances, slips in the RV series can fuel-starve the engine in a matter of just a few seconds. Please consult cockpit placards and your airplane flight manual for warnings about slips before attempting the exercises described below.

Stalls During Slips

How an airplane behaves in a slipping stall depends on several factors. For the power-off, no-flaps slip configuration, three reactions are possible. First, a Decathlon will retain its rudder and aileron authority during the slipping stall. Thus, it's possible to remain on your track in the slip as the Decathlon gently bobs into and out of stall buffet, albeit descending rapidly.

The Cessna 150, on the other hand, loses its rudder authority; consequently, the 150 begins a slipping spiral toward the low wing, bobbing in and out of stall buffet along the way. Even though you cannot keep the Cessna 150 on its original track, the opposite rudder remains suf-

ficiently effective to prevent spin entry. In fact, you can perform a 360-degree stalled slipping spiral if you're so inclined. Airspeed will remain low and constant throughout the high-drag turning descent.

Potentially the most dangerous stall behavior in a slip typically occurs in low-wing airplanes (and some high-wing airplanes with rather poor roll authority, such as the J-3 Cub). The A36 Bonanza, for example, loses its aileron authority in a slipping stall. The Bonanza suddenly and automatically rolls toward wings-level flight, i.e., toward the deflected rudder. If allowed to proceed, the airplane will transition from a slip into a skid. All the ingredients necessary for an over-the-top spin entry are present if we don't respond appropriately: stalled flight plus yaw and roll coupling.

Yet regardless of the airplane or how it reacts to a slipping stall, we still need to deal with stalled flight in the usual manner: break the stall with forward elevator. Reattach the airflow first; then release the slip inputs.

Straight Slips

Let's practice slipping along a straight line. At altitude, configure the airplane as if you were on downwind for landing (no flaps). Take a moment to memorize your pitch attitude. Since the airspeed indicator is inaccurate in a slip, our objective will be to keep the pitch attitude constant as we move into and out of our slips. We'll also leave the throttle set as is. This way, we won't have to climb quite as often between slips. Select a nice section line to follow,

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or a distant point over the nose as an outside visual reference.

Begin the slip by smoothly and slowly yawing the nose to the right of the reference line you want to track. Simultaneously apply sufficient left aileron to roll the left wing tip below the horizon. Establish a comfortable slip angle, and do whatever is needed with the elevator to hold a constant pitch attitude. The maximum amount of slip possible is usually determined by the amount of rudder available. A full-rudder slip in a typical nose-wheel Cessna, for example, results in a relatively small amount of slip compared to a full-rudder slip in a Citabria. Depending on the airplane, your "comfortable" slip could range from full rudder in the Cessna to only half of the rudder in the Citabria to perhaps only one-third or less of it in a high-performance aerobatic airplane.

When pilots enter slips, they often instinctively shift their bodies away from the bank angle in order to remain vertically upright to the horizon. This will throw you off of the roll-yaw-pitch axes of the airplane.

Furthermore, leaning away from the bank will effectively shorten your arm's throw, limiting the amount of aileron you can apply even though more aileron deflection may be available. Once you've set your slip, make sure your upper body is relaxed, with your head and spine aligned with the airplane, not the horizon. Here's a tip: If you release all tension from your upper body, gravity will pull you into the correct position.

Do you have good slip posture? Okay, now check your track: The line you're slipping along extends from your chest to a point on the horizon. The nose of the airplane should be to the right of that line; the left wingtip, down and to the left of the line. Feel free to vary your rudder pressure to see how the nose moves as a result of too much and too little rudder for the particular slip angle. Similarly alternate aileron pressure from too much to too little. Readjust your slip inputs to track the line once again.

Now sight down the left wing and notice that the left aileron is sticking up, yet the airplane is not rolling. Glance at the slip/skid ball. Listen

to the sound of the airflow in the slip. Return to coordinated flight by smoothly yawing the nose back to your reference line while simultaneously rolling the wings to level. The nose will usually want to drop as well, so take care to keep the pitch attitude constant as you remove the slip inputs.

Next, move into a slip with left rudder and right aileron, performing the same coordinated actions and paying attention to the same details as before. Check your posture and your track. Remove the slip. Alternate your slips in this fashion until you can move smoothly into and out of them while consistently tracking your reference line. Then try transitioning the slip from one side all the way across to the other side. Make smooth, slow, and controlled inputs at first. Stay on track, keep the pitch attitude constant, and make your body move with the airplane.

In all likelihood, you'll descend during these slips. Don't try to compensate for the altitude loss; focus instead on your inputs, your track, and your posture.

Slipping Turns

Not only can we track a straight line in a slip, but we can also perform slipping turns. Try the following at altitude: Configure the airplane for slow-cruise. Note the pitch attitude relative to the horizon, which should be lower than the slow-flight pitch attitude used during your straight slips. Keeping this new pitch attitude constant, smoothly transition into a straight slip using left aileron and right rudder.

Let's now keep the rudder position constant. We'll vary only aileron and elevator for a left slipping turn. Smoothly increase the bank angle another 10 degrees or so. Next, smoothly apply a small amount of aft elevator. Allow the airplane to turn, and don't change the rudder! The slipping turn rate will seem quite a bit slower than a comparable coordinated turn. Also notice that the nose of the airplane appears to be lagging – to be following you – in the turn; thus, you should be looking ahead of the nose in the direction you're turning. Acknowledge the heaviness

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Intentional and controlled uncoordinated flight requires coordinated control inputs and practice. Photo courtesy of Rich Stowell.



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Mastering uncoordinated flight will improve forward visibility in blind airplanes such as the Pitts. Robert Bismuth.

you feel in the left side of your butt. Check your body posture. Lean into the turn, not away from it. Glance at the slip/skid ball which is resting left of center.

Let's now transition back to our straight slip by reversing the order of inputs applied to initiate the slipping turn. First, release the additional back elevator. Second, reduce the added bank angle. You should now be in a straight slip, tracking a straight line.

You'll find that the difference between the straight slip and the slipping turn is a subtle difference in aileron and elevator pressures. From that standpoint, think pressure changes rather than measurable movements of the controls. Also, make two separate inputs at the start and at the end of each slipping turn: aileron followed by elevator to start; elevator followed by aileron to stop.

Try a four-point, 360-degree slipping turn to the left, briefly transitioning to a straight slip every 90 degrees of heading change before resuming the slipping turn. Do the

same to the right as well. You can also experiment with holding the ailerons constant and modulating only rudder and elevator pressures. In this case, release a small amount of rudder pressure followed by a bit of aft elevator pressure to start the slipping turn. Release the aft elevator pressure and reapply rudder pressure to straighten the slip.

Controlled Yaw Exercises

Okay, we're ready to play around with moving the nose of our airplane to scribe various shapes in the sky. Let's create our shapes as follows: We'll draw horizontal and vertical lines only (for now), we'll keep the corners between horizontals and verticals square (no rounding off!), and we'll keep the wings perfectly level at all times.

Draw a box. Start in level, slow-cruise flight. From here on, leave the throttle alone. Pull the nose up along a straight line 15 to 20 degrees above the horizon. Pause there for a second. Now yaw the nose left, keeping the nose parallel to the horizon and

the wings level. Pause. Now push the nose down along a straight line 15 to 20 degrees below the horizon. Pause. Yaw the nose right, parallel to the horizon, wings-level, back over to the starting heading. Pause. Return to the slow-cruise flight attitude. Do the same thing to the right. Keeping the wings level and your lines perfectly horizontal and vertical will require continuous adjustments as speed, control authority, engine effects, and gyroscopic precession vary and interact.

Once you're comfortable with that, spell out "CATS" in big block letters. Then "DOGS." Etch the numbers zero through nine and the various letters of the alphabet. Spell out your name. When you're proficient with block figures, try scribing a few wings-level, 45-degree lines with the nose. And when you get really good, cursive skywriting awaits you!

Don't worry about holding a constant altitude during any of the slip exercises. Plan on starting high enough to compensate for the attendant altitude loss, and regain altitude

between maneuvers. Be vigilant for other traffic, too. And as mentioned in the previous installment on sequences, abort the exercises if either altitude or stalling becomes an issue. ✈

Rich Stowell is a NAFI Master Instructor-Aerobatics. His much-anticipated new book, The Light Airplane Pilot's Guide to Stall/Spin Awareness, hits bookshelves in February. For more information, visit www.RichStowell.com.

Editor's Note: In 2007, Sport Aerobatics will continue to provide how-to articles designed to increase the safety, skill, and knowledge of our recreational and competitive members. Please let me know what topics you would like to read about in upcoming issues. Do you have a maneuver that remains a mystery? What about emergency procedures? How are those "forward blind" landings working out? Please send your suggestions to me at tookyflyer@tds.net. This is an opportunity to fly with the very best aerobatic flight instructors without worrying about the price of avgas!

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