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INTERESTING WAYS *to* Bore Holes *in the* Sky

Photo by H Dean Chamberlain

The pilot in the left seat looked both ways to clear the area and then started a gradual climbing turn in the direction of the 45-degree reference point he had already selected. I was pleased to see that he had planned, and now controlled, the climbing turn so as to reach the maximum pitch-up attitude at the 45-degree point. The rate he used to roll into the bank was just what he needed to prevent the rate of turn from becoming too rapid. As too many pilots learn the hard way when attempting this maneuver, anything but the proper (slow) rate of roll will cause the rate of turn to be too rapid, and the nose of the airplane will reach the 45-degree reference point before it attains the highest pitch attitude.

At the 45-degree point, the pitch attitude was at maximum and the angle of bank continued to increase, but now the pilot also started to slowly decrease the pitch attitude toward the horizon and the preselected 90-degree reference point. Since the airspeed was still decreasing, he applied right rudder pressure to counteract torque. As he lowered the airplane's nose toward the 90-degree reference point, the bank continued to increase, and he used the merest touch of opposite aileron to prevent the bank from becoming too steep. When the airplane completed 90 degrees of the turn, the bank was at the maximum angle (approximately 30 degrees), the airspeed was at the minimum (5 to 10 knots above stall speed), and the airplane pitch attitude was passing through level flight.

I watched as the pilot continued to fly the airplane into a descending turn, so that the airplane's nose traced an imaginary loop below the horizon the same size as it had just flown above. As the pilot's reference line passed through the 90-degree point, he gradually decreased the bank and allowed the airplane's nose to continue lowering. When the airplane had turned 135 degrees, the nose was at its lowest pitch attitude. Since the airspeed was increasing during this descending turn, he compensated by gradually relaxing rudder and aileron pressure. Simultaneously, he raised the nose and rolled the wings level. He noted the amount of turn remaining and adjusted the rate of rollout and pitch change so that the wings became level and the

These maneuvers will make you a more proficient pilot as you take the airplane through a wide range of airspeeds and altitudes.

original airspeed was attained in level flight just as the 180-degree point was reached. Upon reaching the starting altitude and the 180-degree point, he immediately started a climbing turn in the opposite direction toward the selected reference points, and completed the second half of the eight in the same manner as the first half.

I had just witnessed one of the best lazy eights I have ever seen.

A "Lazy" Eight Requires a Working Pilot

The lazy eight is one of the performance maneuvers required for the commercial pilot certificate. Notwithstanding the name, this maneuver makes the pilot work to master it, and most pilots need at least several attempts before it begins to make sense. One of the big keys to understanding the lazy eight is learning to visualize exactly where you need to be at every point in its execution; that is, where you need to be in terms of pitch, bank, airspeed, coordination, and the chosen reference point.

Along with chandelles, eights-on-pylons, and steep turns, the lazy eight is one of the maneuvers that make the commercial pilot certificate one of the most fun to obtain. Yet, why wait until you're working on the certificate to learn it? These maneuvers are a lot of fun to fly. More importantly, they will help make you a more proficient pilot because they require you to learn about energy management, about how the effectiveness of flight controls changes with airspeed, and about precise coordination of controls through a wide range of airspeeds and altitudes.

If you're up for a real challenge, nothing increases pilot proficiency more than aerobatic flying.

As a training and proficiency maneuver, the lazy eight has particularly high value because it requires constant variation of forces and attitudes. Indeed, it is the only standard flight training maneuver during which the forces on the controls are never constant. As such, it helps the pilot develop subconscious feel, planning, orientation, coordination, and speed sense. It is not possible to do a lazy eight mechanically, because the control pressures required for perfect coordination are never exactly the same.

Performance Requires Proficiency

Like the lazy eight, chandelles and eights-on-pylons are performance maneuvers that require maximum pilot proficiency. That's the point of these maneuvers, as you aren't likely to need them during your typical cross-country flight from Airport A to Airport B. Let's take a look at what they require and at how they demand the most in pilot proficiency.

Done properly, the chandelle is as elegant as its name. It is a maximum-performance climbing, 180-degree turn that starts with rolling into a 30-degree banked turn, adding power as needed and pitching up. In a correct chandelle, you reach the maximum pitch attitude at the 90-degree point of the turn, and maintain that pitch through completion of the turn. If you haven't pitched up enough, you won't get high or slow enough by the end of the maneuver. On the other hand, if you have pitched too steeply, you'll stall before completing the turn.

In the second half of the chandelle, you slowly roll out, timing this process to finish the turn just as you reach the 180-degree point. If you don't roll slowly and continuously, you might very well have to increase the roll rate at the very end of the turn. On the other hand, if you decrease the roll rate too quickly you will fail to complete the full turn.

It's not hard to see that a successful chandelle requires a great deal of pilot judgment, situational awareness, control finesse, and overall proficiency.

You can also increase your proficiency as a pilot by learning to fly eights-on-pylons. This maneuver requires understanding of a concept called "pivotal altitude," which, in turn, demands the same blend of coordination and division of attention you need for the other maximum-performance maneuvers. In a nutshell, this one is a ground-reference maneuver that requires circling about a "pylon," keeping a reference point on the wing pointed at the pylon, then breaking off the turn and flying a straight line for a short distance to a point where you enter a turn in the opposite direction around another pylon.

Groundspeed determines the pivotal altitude, which is the specific altitude required to keep the reference point on your wing pointed to the reference on the ground. If there is a tailwind, you will have to climb as your groundspeed increases. Conversely, you will have to descend with a headwind.

Situational awareness is obviously important, but so is basic aircraft control. One of the challenges is to not cheat with your feet, that is, do not try to use rudder to keep the wing on the pylon. This maneuver is to be flown with coordinated controls. One easy way to think about it is that if the pylon is moving behind the wing reference you will need to increase

back pressure. If the pylon is moving forward, i.e., as you turn into a headwind, push forward on the yoke.

Really Unusual Attitudes

If you're up for a real challenge, nothing increases pilot proficiency more than aerobatic flying. It is a challenge to fly around all three axes of flight with enough situational awareness to know which way is up. Gaining precision in these maneuvers offers a wonderful sense of accomplishment. It also makes you a better pilot.

In addition to the fun factor and proficiency points, there is another important reason for every pilot to consider at least some basic aerobatic training. Even if you are the sort of pilot who dislikes banks in excess of 30 degrees, or if you never pitch up or down beyond 10 degrees, there might very well come a time in your flying when the blue side is down, not up. And, it probably didn't get there because of something you did on purpose.

I speak from experience. Awhile back, I took initial *Malibu/Mirage* training. It was the last day of training; I thought I knew what was what. The simulator I was "flying" was not a motion device, but it did include a full cockpit mockup with projection on a screen that wrapped around outside the cockpit windows. The instructor asked me to close my eyes so we could do unusual-attitude recoveries. I dutifully complied and waited for instructions to open my eyes and recover from whatever attitude I found myself in. I admit to being slightly smug, because I wondered how the instructor could possibly disorient me in a non-moving bolted-to-the-floor flight-training device. When the instructor told me to open my eyes and recover, I had a, "You've got to be kidding me" reaction. The blue side was down. The airspeed was trending up. Even though I wasn't hanging from the shoulder straps, this simulated *Mirage* was inverted.

How would I recover? Would I pull back on the yoke? That would result in a split-S, a maneuver that pulls from inverted through the second half of a loop. Or, would I add forward pressure to the yoke and then roll back to straight and level?

The school had added this exercise to the syllabus precisely because too many pilots responded to this kind of upset—and, sadly, too often in a real airplane after encountering wake turbulence—by performing a split-S only to become much more upset when the wings departed the aircraft as a result of reaching speeds well in excess of V_{NE}. A pilot who has the benefit of aerobatic training, however, would be more likely to overcome the "pull" instinct and know that the roll is the safest way to recover from this kind of upset.

Overcoming the natural instincts that can be killer instincts in an airplane is one of the greatest single proficiency benefits to aerobatic training. The only safe way that pilots can gain the sometimes counter-intuitive skills needed to recover from these kinds of upsets is through basic aerobatic, or upset recovery, training. Will you experience some motion sickness during the training? Possibly. Is your adrenalin valve going to be wide open? You betcha! Yet, even if you only receive one hour of aerobatic training, you will be much better prepared to recover from an upset if it ever happens to you. You will know how to get the blue side back on top if you ever find it down. And, you will be taking yet another step in the transition from good pilot to great pilot—and a proficient one.

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Photo by H. Dean Chamberlain