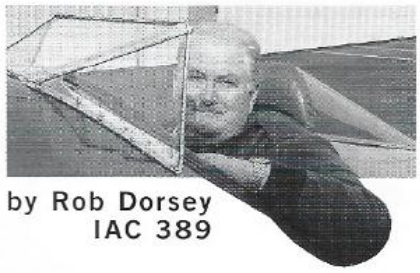
Stick & Rudder



by Rob Dorsey
IAC 389

Easy Does It

Easy and Gentle, Low G Aerobatics for the Recreational Pilot or a First Ride

So my buddy with the Waco says: "Competition schmompetition, what the heck's wrong with just a nice loop and a roll? I mean, what if you ain't got no inverted system and wouldn't want to dump oil all over the belly if you did? Sheesh! When will you G-junkies just relax and enjoy the simple pleasure of smoothly rolling the horizon around the nose? For a lot of us, pal, competition just ain't necessary, but aerobatics is."

There's a new wind blowing around our "sport," one that challenges the very meaning of the term. Throughout our social and business lives we are encouraged, even required, to accept and value the diversity of the people around us, yet, in our "sporting" lives, we IAC competitors sometimes don't and, therefore, are often viewed as exclusive by the very folks we would endeavor to attract.

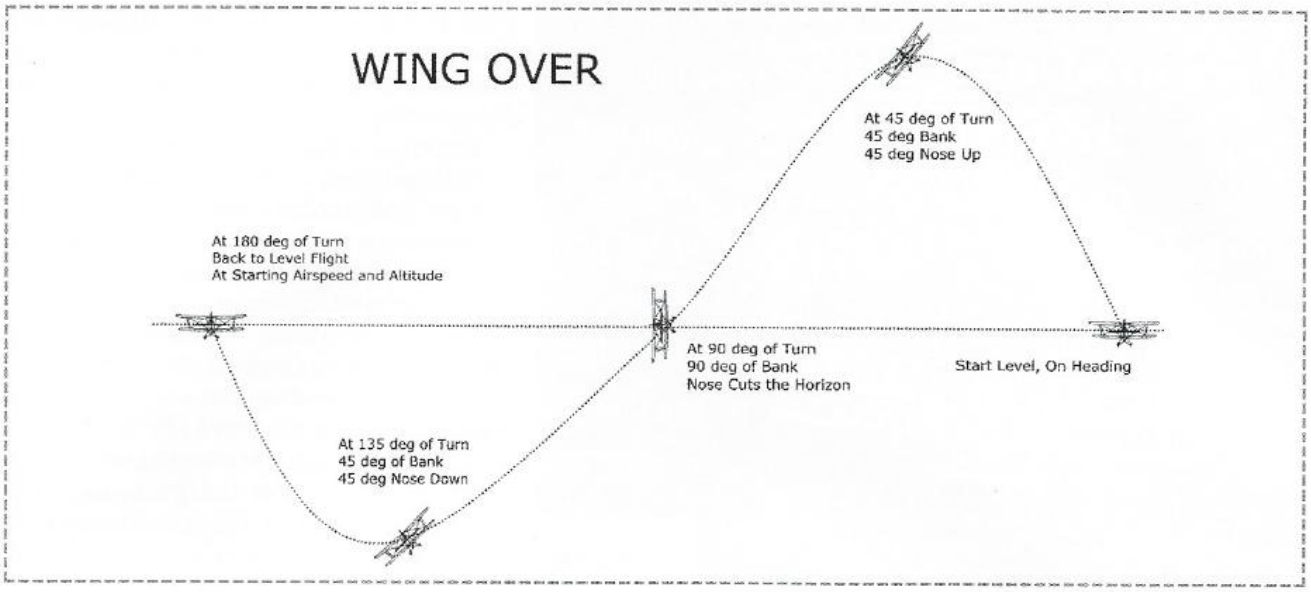
Webster says: ex clu sive adj. < L exclusus, 1. Excluding or tending to exclude all others; shutting out other considerations, happenings, existences, etc.

Aerobatic competition is a demanding and rewarding art, full of personal challenge and the opportunity for excitement (anticipated or otherwise) and attended by at least some exposure to danger. It requires a heck of a lot of dedication to pull off, from the logistical problems of getting the money and free time to participate to the often dicey task of flying long cross-countries in airplanes poorly suited to the job. The payoff, besides the possibility of winning both the approval of our peers and a trophy, is the time spent with good friends, the hospitality of the organizing IAC Chapter (the barbecue and beer factor), and the personal satisfaction that comes from doing something of which mere mortals can only dream.

But, what is the meaning of "aerobatic pilot" in today's context, right now, in IAC? The Roman philosopher/emperor Marcus Aurelius wrote: "To know a thing you must first understand its nature. You must divine its needs and ask of yourself, what does it seek." So, what do we seek, we aerobatic pilots? Do we compete because we feel within ourselves the hard kernel of competitive spirit so strong that we need to fly against others and win, thereby proving ourselves to be the superior pilot? To be sure, some do. And we seem to need to wrap our pursuit in structure and rule as well. It is not enough to merely make it beautiful. We chose to take aerobatic flight, arguably the most extraordinary manifestation of pure freedom a human being can enjoy, and turn it into a discipline! Go figure, huh?

If you walk the flight line at Sun 'n Fun or EAA AirVenture Oshkosh, you will meet dozens of aerobatic aircraft owners who have the will and the skill to take an airplane beyond the world of straight and level, yet they have no need to compete. Many of those who have lovingly built or restored the airplane of their dreams don't want to subject it to, what they perceive to be, the rigors of competition flying. And, it is possible that your airplane is simply not suited for competition, perhaps because it's a valuable warbird or an irreplaceable vintage machine. Either way you may seek maneuvers that fit your needs. Aerobatics, you say? Certainly, by all means, but not at any cost. Here then are a few maneuvers for you to consider and try. They are purely recreational and easy on your airplane, but they will provide endless challenge and pleasure as you work to improve and perfect them.

For many years I taught aerobatics to those who had never ventured beyond the aerial pabulum offered up to ab initio flight students. To be successful I had to devise a syllabus for the introduction of the very idea of aerobatic flight and do so in such a way as to make them come back for more. I had, after all, a living to earn. I found that most people responded best to a smooth building-block approach, with each maneuver having relevance to the preceding and building upon the skill set so as to make the next step achievable. First I found that these people needed improved orientation. Lots of improved orientation. And the absolute best figure to develop that is the wingover, described in detail in the January 2001 "Stick & Rudder" column, "In the Beginning...."

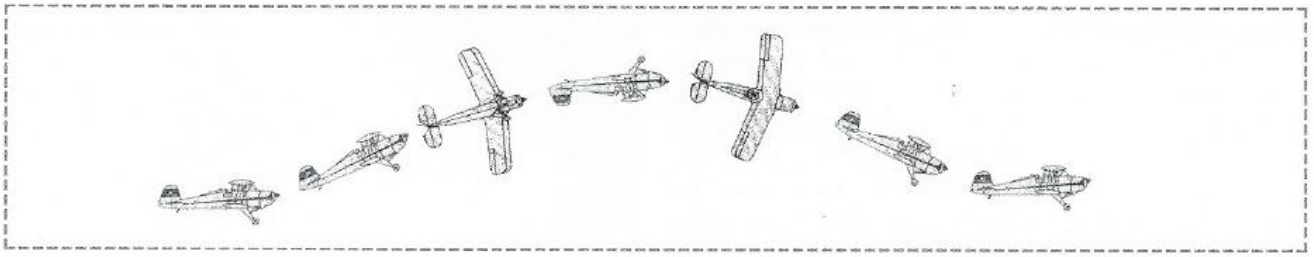


When evolved into the aerobatic lazy eight by combining two wingovers of opposite direction, the wingover makes the pilot manage attitude and energy throughout constantly changing altitudes and airspeeds while hitting precise orientation points along the figure. In my humble opinion (my wife, Robin, tells me that I should never use that expression since I have never, to her knowledge, had a humble opinion), you should not proceed on to more difficult aerobatic figures until you have mastered the challenges of the precision aerobatic wingover, both right and left.

Once you do, you can now move on to the aileron roll. The aileron roll is the most fundamental of rolling maneuvers and, properly executed, is no harder on your airplane than rolling briskly into a steep turn. Of course, it can be botched, and the result can be, as in any blown maneuver, ugly. You must not, under any circumstances, pull through from the inverted position of the roll. Your speed will be too high, and you will probably exceed your airplane's VNE. At the very least you will pull a bunch of Gs and lose a wad of altitude. At worst you could blow some fairings off or even break your airplane, requiring you to learn sky diving without an instructor or a reserve chute. Personally, I just hate doing anything I have to do exactly right the first time.

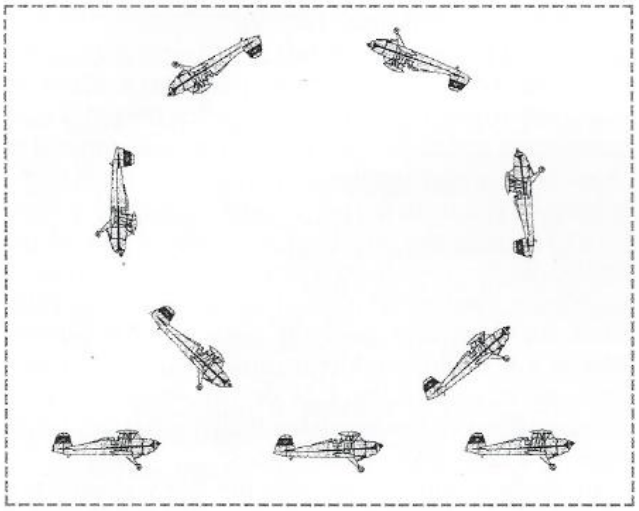
The aileron roll is a ballistic figure, with the airplane's center of gravity tracking an arc across the sky as the airplane rolls. That means, then, that we must manage that arc to accomplish a smooth and controlled figure. Most airplanes like to aileron roll at a speed similar to that used for a loop, perhaps a bit less but not much. At the proper speed, say 130 mph in a Citabria or 180 mph in a T-6, the nose is smoothly but aggressively pulled up to about 30 degrees above the horizon prior to starting the roll. Before introducing any aileron, the stick is "checked" forward to eliminate any pitching moment. This is the secret to the maneuver. Pull up to the proper pitch attitude, check the stick to neutral, and only then apply aileron toward the desired direction of roll, accompanied by a little rudder to coordinate. The very act of checking the stick forward unloads the wing and markedly decreases any adverse aileron yaw so little rudder is usually required. In fact, some airplanes, like the T-34 or T-6, respond well to checking the stick forward to less than normal, 1 G flight. Even so, a little rudder usually helps.

In airplanes with considerable roll rate you need not use full aileron, but in slower rolling types, i.e., most, full aileron should be used. Use extra effort to keep the aileron in throughout the roll; many pilots have a tendency to relax the aileron across the inverted segment of the roll. Make certain you do not introduce any back stick. You do not need to push the stick forward when passing through inverted, but rather allow the CG to track along its ballistic path at near 0 G. As you roll toward wings-level flight, the nose will naturally drop to about 30 degrees nose down, and this is as it should be. You will see about +2.5 (your initial pull-up) and 0 on the G-meter, and when you recover to level flight, you should be at about the starting altitude. If not, adjust the initial pitch. If you still end up more nose down than you think you should be, add a little extra entry speed. You can tweak and tune this roll until it is a thing of beauty.



A plain old garden-variety loop can be a delight in just about any airplane, particularly if no requirement exists to make the loop round for a ground observer. You are only worried with how it looks from the cockpit, and that gives you considerable leeway indeed. The best looping speed for most airplanes is about 2.5 times the stall speed. It can be done at much higher speeds, particularly in more advanced warbirds, and at slower speeds if you are very careful and very good. Using that formula, if your airplane stalls at 55 mph indicated airspeed, then the looping speed is about 140 mph. The loop has been covered admirably in lots of books by authors with much greater credentials than mine, some of which are bound to be on your shelf, so I won't try to detail it here.

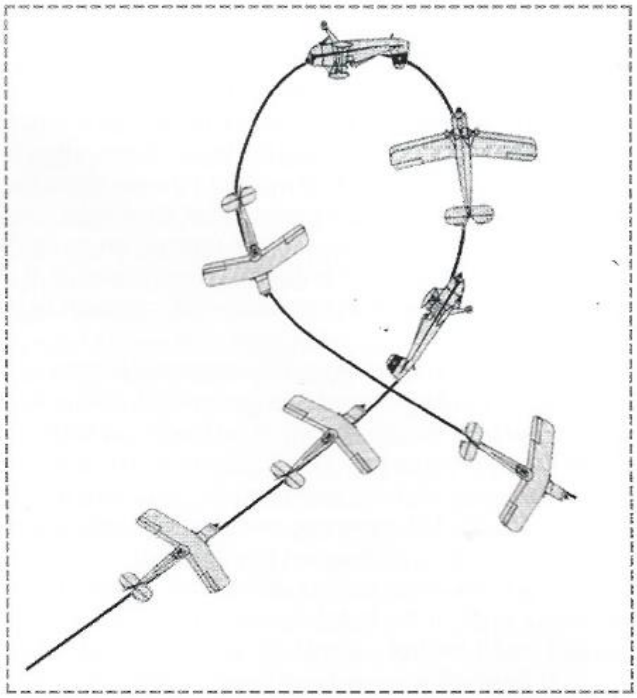
Continue to fly the loop as you roll and keep your eye on that landmark because that is your target.



Just remember that a nice loop can be done with a surprisingly easy pull-up, and you should transition your gaze from the nose to the wingtip after the horizon is lost. Stay on that wingtip and keep it rotating smoothly until about 30 degrees before inverted and then transition back to the nose to watch it come down through the horizon. Keep smooth but firm back pressure on the "back side" as you pass through the vertical-down attitude and pull out at about the same G as you entered to preclude speed buildup. Resist any temptation to pull tighter on the exit than you did on the entry. This will "tighten up" the pullout and actually result in increased altitude loss. Even though you are pulling out from a vertical dive, you are still flying the wing, and the best lift/drag angle of attack will give you all that your airplane can offer. Most good loops result in about 3.5 Gs, but they can be done at less. More than 4 Gs is not usually required.

Once you have practiced all of the above, here's a nice little sequence you can use to show a guest how smooth and in control you are: do a loop followed by a wingover followed by an aileron roll, then do another wingover, and finish with a loop. To someone new to aerobatics, this is thrilling without being too much. I have probably given more than a hundred first aerobatic rides, and I've found that the wingover, loop, and aileron roll are consistent favorites with first-time aerobats.

The cloverleaf is another wonderful recreational figure that you don't see much anymore because it isn't used in competition. Each of the four segments of this graceful and flowing maneuver is actually a cross between a wingover and a loop in which the airplane enters a loop, rolls 90 degrees during the climbing portion, and then continues around the vertical circle, exiting 90 degrees from the original heading. Some competition pilots try to fly this figure as a vertical quarter roll and a quarter loop. In my opinion, this destroys the grace and fluid rhythm of the figure. It should flow as one continuous ribbon of loop and roll.



To do the quarter cloverleaf, pick up your normal looping speed and align yourself with a prominent ground feature like a road. Begin a pull-up just like a normal loop, but as you approach the vertical (remember you should be looking at the wingtip by now), pick out a good landmark 90 degrees to your left and keep it in sight. You should now introduce a little left aileron, and maybe just a hint of left rudder to coordinate, to roll the airplane 90 degrees. Continue to fly the loop as you roll and keep your eye on that landmark because that is your target. You want to arrive at the top of the loop, the inverted position of the figure, exactly 90 degrees from your entry heading with the nose pointing at your target. This is where the experience gained in the wingover is of great advantage. In the wingover you learned to pick a point 90 degrees from your entry heading and to fly the nose through that point. Here, you will fly though the same

point, but you will have continued the roll so as to arrive at the point inverted. Once there you will proceed as if you had done a loop, pulling through smoothly to level flight, 90 degrees from your entry heading. If the aim point you chose for the top of the figure is 90 degrees to your left, then you will exit the figure 90 degrees to the right of the entry heading. Just like the wingover, the cloverleaf is done properly when you hit precise attitudes at precise points and recover at the same altitude as the entry. Strive for precision and perfection because that is the quest that will bring out your own personal best.

Once the quarter cloverleaf is truly in hand you can start to link them together to form the full cloverleaf. I would suggest that you do this by adding one segment at a time. When you have added the fourth segment, you will see that, although smooth and flowing, the full cloverleaf is a busy couple of minutes.

Well, there you have four figures that allow you to develop your skills and orientation while having a heck of a good time. None of these figures are hard on your airplane, or you, and all will work well when you are called upon to do an aerobatic ride. Take it easy on the "newbie" and make him or her want more. In 1970 I took a young lad named John Harper for his first aerobatic ride in the Tiger Club's Stampe. He went on to become my student, a four-time member of the British Aerobatic Team, a professional air show pilot, and an aerobatic instructor. Who knows what your ride just might give rise to.