Teaching the Basic Aerobatic Course

Jim Koepnick

Part One: Laying a good foundation

This is the first of a series of articles about teaching a basic aerobatic course that includes the four fundamental maneuvers of aerobatics (loops, rolls, hammerheads, and spins). The series will focus on the instructor who wants to learn more about teaching the basic course, but will also be helpful to those interested in beginning aerobatics.

Flight instructing is an art, and therefore is personal. I will share my techniques and philosophy, but in the end each instructor will teach with a style of his or her own. Therefore, the information shared here is not meant to be a judgment of the quality of the instruction given by anyone else.

GREG KOONTZ, MCFI-A

I started a lifelong aviation career by becoming a flight instructor at the tender age of 18. Five bucks an hour and all the flying I could ever want. What a deal! I learned to teach from an old veteran named Richard Millar—or Mr. Millar as I always called him. Mr. Millar was truly a lifetime instructor. Starting his own career as a young instructor in the Civilian Pilot Training Program in the ’40s, he had more J-3 Cub instructing time than Carter has peanuts.

I found Mr. Millar when I was looking for an instructor to teach me to fly my own restored J-3. Millar did just that, and later, when I sold that Cub, he worked with me on my commercial certificate and multiengine rating. But more importantly, Millar took me on as his student for the flight instructor certificate. It was “old school” at its best, and I locked on to that old man’s every word.

Mr. Millar told me, “Young feller, there’s telling, instructing, and teaching. You want to be a teacher.” Though it didn’t come quickly, what he really meant eventually made good sense to me. You can tell people what to do, you can instruct them in the

steps to get it done, or you can teach them in such a way that the instruction becomes ingrained in their thought process.

Millar said that some instructors just "show and tell." They have their students read the book, they take them up in the airplane, they demonstrate how it's done, and then they give the flight controls to the student so he or she can give it a try. If the student can successfully repeat the action, he is considered to have learned it. Little concern is given to the depth of the student's understanding. Many people pass their private pilot checkrides with flying colors by being able to perform each step of the required maneuvers without really having much understanding of what they were doing. It's called "show and tell."

Teaching is bringing a student to a new understanding. It's like drawing a picture in that person's mind. Sometimes it's necessary to break down what's expected into individual steps, but these steps should never be the whole package. The student should see it as the instructor sees it. He needs to have a picture. Mr. Millar used the technique of literally drawing pictures on paper as he explained things. He told me never to save the drawings but instead to let the picture unfold as you present it with your explanation. The trick is learning how to be thorough while trying to keep things reasonably simple.

HABITS BECOME FUNDAMENTALS

The average student coming to Sky Country Lodge for aerobatic instruction is a pilot who generally flies for pleasure or personal/business reasons. Many either fly often, but basically do the same flight over and over, or fly infrequently—say, 30 hours a year tops. Most handle their primary aircraft well and have formed definite habits. In fact, since most people fly the same airplane every flight, they tend to fly by habit. That is, they have procedures for everything.

Teaching basic aerobatics generally starts by interrupting habits and instilling long-forgotten fundamentals. I find that almost everyone who takes the course stumbles a bit when asked questions about basic aerodynamics. These can be questions as simple as, "What makes an airplane turn?" or "What is the rudder for when starting a turn?" Years of set procedures can override the need to think through each action. The first goal of the aerobatic instructor, long before the first roll, is to reconstruct a sound foundation of the fundamentals of flight.

A sound structure requires a strong foundation. Teaching is like building a pyramid. Starting at the bottom, the instructor lays that foundation and then lays the necessary pieces carefully on top, one layer at a time. To skimp on the blocks just weakens the structure. So take the time to build the entire structure. Draw the picture in your student's imagination carefully and thoroughly. I have consistently found that when I attempt to skip something, particularly when I assume the student already knows the information, I begin to leave gaps in learning that invariably return to haunt me later.

The real trick is to keep it simple. Over the years I have learned which fundamentals of aerodynamics to apply to the basic aerobatic course, and I avoid the rest. I use the old instructor's adage, KISS, or Keep It Simple, Stupid! No one is looking for the formula for best L-over-D (lift over drag) here. Aerobatics is an art and things such as "feel" and natural intuition come into play. I have yet to do a loop with a slide rule. We use a sense of judgment to fly, so instructing your student on how a maneuver should look and how it should feel becomes more relevant than the math.

EASY AERODYNAMICS for AEROBATIC PILOTS

My "fundamentals of aerodynamics" starts with a discussion of lift. We are converting a normal pilot to an aerobatic pilot. Most pilots are taught to fly relative to straight and level. They learn to re-create their earthly two-dimensional existences in the sky. If asked, most students will tell you it requires back-stick pressure to make a turn. This does seem reasonable and would normally be an acceptable statement. But this assumes the desire to maintain level flight. Our goal as aerobatic instructors is to change two-dimensional thinking into three-dimensional thinking. If you get right down to it, *anytime* you bring the direction of lift away from straight up, the lift will cause a curved flight path. Going from level flight into a bank will cause a descending turn if no additional lift is created with back-pressure. Where we point the lift is a big issue in aerobatics.

> **"YOUNG FELLER, THERE'S TELLING, INSTRUCTING, AND TEACHING. YOU WANT TO BE A TEACHER."**

The wing just doesn't care what attitude it's in. Straight up, sideways, or upside down, it is simply going to do its thing as long as it's being pushed through the air. This really becomes important if we attempt to roll without doing something with the lift! When I was a 16-year-old student, I was sent out of sight of the airport on my first solo to the practice area. As a "bulletproof and invisible" teenager I decided this was my big chance to do a roll. So it was up with the nose and in with the ailerons, with no consideration given to what I was doing with lift. The result was ugly. First, lift made me turn, but as the plane went over on its back, lift and the airplane's weight combined in a frightening pitch toward mother earth! Lesson learned: Lift is the nemesis of roll.

This leads us to a discussion of angle of attack (AOA), or, simply put, what changes as we adjust the angle at which the wing strikes the air. Aerobatics is a continuing series of changes to AOA to change lift. Positive AOA is the normal condition where the wing strikes the air with the bottom of the wing, and negative AOA is where the wing is asked to produce lift in reverse with a forward stick position. Right in the middle where the wing strikes at a neutral angle there exists a "zero-lift" AOA. We use positive and negative AOAs to fly right side up and upside down respectively, and we use the zero AOA whenever lift is not desired (like flying vertically or performing the basic aileron roll).

As we explore these different AOAs, we find certain things to be true. First, flight in the positive AOA causes adverse aileron drag when applying ailerons to roll. This requires the application of the corresponding rudder to correct—that is, left rudder for left aileron deflection and right rudder for right aileron deflection. In a negative AOA, the aileron drag is in a mirror image of itself, meaning now you will need right rudder to coordinate a left aileron application and vice versa. At zero-lift AOA, the ailerons create equal quantities of adverse yaw, so no rudder corrections are

required. When you see that Extra 300 doing a perfect vertical roll, the pilot is using lots of aileron deflection but ideally no rudder for aileron drag. When we begin our discussion on specific maneuvers such as rolls, these issues will come up.

LOOK OUTSIDE the PLANE

One more issue to discuss with your student before getting to the maneuvers is orientation. Flying aerobatics depends a lot on the ability to keep up with exactly where we are in relation to mother earth. Staring at blue sky tells us nothing, so we have to be prepared to move beyond the natural tendency to fly our planes while looking straight ahead over the nose. I use a maneuver I call the "crazy-eight" to develop these skills. It is essentially an exaggerated lazy-eight from the commercial pilot requirements. Mine involves using a ground reference such as a long, straight stretch of road instead of a point on the horizon. The idea is to fly the S-turning, climbing, and descending course more like a skateboarder on a giant half-round pipe! Fly big wingovers at the top, then cross the road in level flight. This requires the student to plan a course for the airplane, using the road as the reference. The only way to do this is to turn one's head back and forth from wingtip to wingtip, keeping track of attitude and position. This helps break the student's old habit of staring straight ahead, while introducing them to the world of big attitude changes that is fundamental to aerobatics.

SINCE MOST PEOPLE FLY THE SAME AIRPLANE EVERY FLIGHT, THEY TEND TO FLY BY HABIT.

I hope you are noticing by now that there is a lot of ground school before we ever get to the aircraft. A flight without a good briefing can be a big waste of time. There are just too many things that need to be understood to allow us to skip the ground briefing and jump into the airplane. Just remember to keep it relevant, simple, and no longer than about 45 minutes to an hour, depending on the student and the subject matter.

Purposely left out of this discussion is the first aerobatic maneuver. I teach my basic course in a specific order: aileron rolls, loops, hammerheads, and spins. It is a four-lesson program that introduces a new maneuver with each lesson, while reviewing the previously learned maneuvers. By starting with the aileron roll on the first lesson, there are four more lessons to develop that initially awkward roll into more of a perfected slow roll by the end of the course. Just how much of a slow roll that final product ends up being depends on the student's progress.

The second part of this series will begin a progression through each lesson and will discuss the trials and tribulations of teaching (and learning) basic aerobatic maneuvers. Meanwhile, please direct any questions you may have about teaching or taking aerobatic lessons to *greg@gkairshows.com*. If you want to share your own opinions, please feel welcome. We are all looking to learn.

Greg Koontz has earned the master certificated flight instructor-aerobatic designation and has been teaching basic aerobatic courses since 1974. He is a full-time aerobatic professional who is sponsored by American Champion Aircraft and flies air shows in his Super Decathlon, an aerobatic competency evaluator (ACE), and a member of the International Council of Air Shows ACE Committee. Greg is also a member of the National Association of Flight Instructors and actively supports its efforts to raise the standards for aerobatic instructors.