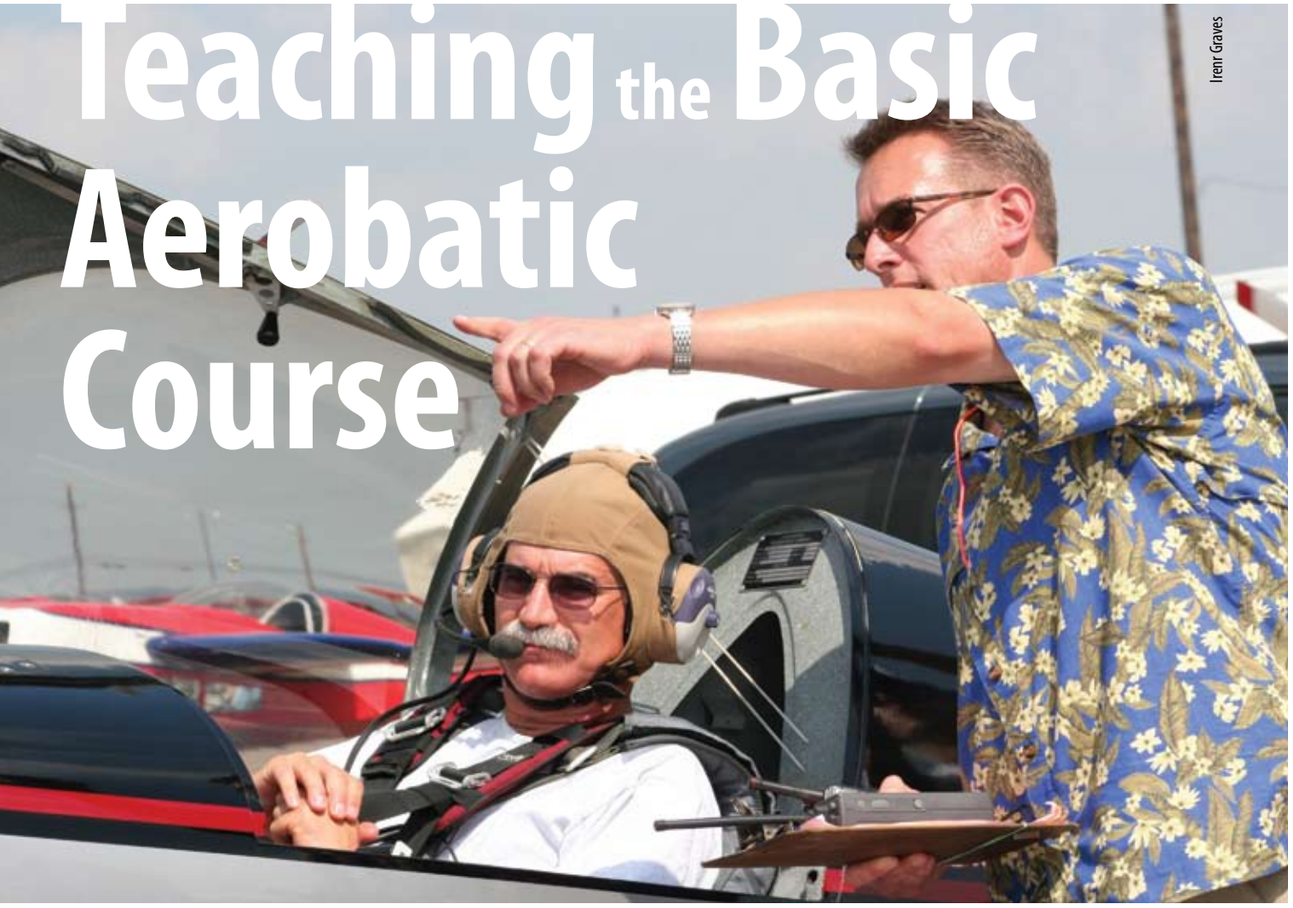
Teaching the Basic Aerobatic Course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Part Two: The first lesson

This is the second article in a continuing series on teaching a basic aerobatic course. With this article I share with those interested my personal techniques that I have developed over years of instructing. Teaching is an art and therefore very personal. These methods work well for me; however, they may not be the same ones other experienced instructors use. Nothing in this article is meant to judge the quality of other instructing styles.

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Part one of this series was devoted to the task of laying a good foundation with your student through ground instruction. I cannot emphasize enough how important that is. Never assume a student knows anything, so start every lesson with this opening: "I'll start with the basics. I mean the very beginning. I will ask questions to see what you know, then I'll use that answer to bring your thinking around to how I would like you to see it from now on. It's not that you're wrong; it's simply that aerobatic flying is a three-dimensional world, and we are going to transform your thoughts of straight-and-level flight to thinking about flight in all three dimensions."

Before we start the flying lesson, a brief note about safety. Your student is watching you even if you haven't noticed. So, do a great preflight on the aircraft, brief your student on all related emergencies and equipment, and fly high and in the proper airspace. You're a prime cut of an aviator, so don't be remembered as a hot dog!

In the first lesson, the goals of the aerobatic instructor are not what you might expect. This isn't the opportunity to show your student all the exciting maneuvers she is going to be learning, and it definitely is not the chance to prove your superior skills as an aerobatic pilot. It truly is your first shot at scaring the student away forever, so hold your guns! I tell people that if their instructor has a habit of wanting to show them his aerobatic routines, they might actually be paying for the instructor's practice! Be a professional and leave the play for airplane rides.

LESSON ONE: RELAX AND BREAK THE ICE

The first goal of lesson one is to familiarize the student with an aircraft that is likely to be a great deal different from her usual mount. Relax and give the student time to fly around and get oriented with the new aircraft. Have her operate the controls to set up straight-and-level flight. Give her some turns, but don't give her headings; instead start a good habit of looking outside by giving her places in the distance to turn to. Do some steep turns, slow flight, and very simple stalls. You want her comfortable and familiar with the plane. This should take the first 30 minutes!

The second goal of lesson one is to break the ice. The person with you likely has some anxiety about aerobatics! The first 30 minutes of familiar maneuvers generally helps, but now it's time to start gently moving to the new. In my first issue of this series we discussed the crazy-eight maneuver I use to teach orientation. This is the next part of the lesson. Choose a road and set up this S-turning series of wingovers above a nice and long reference like a road or railroad tracks. Start the maneuver by slowly describing how it will look like a skateboarder in a giant half-round pipe. Let the student take over the controls, and as you both go climbing and diving along the road, encourage her to make them bigger and bigger. Watch the student carefully to ensure she is moving her head and eyes to the reference. And, for sure, watch her carefully so that she doesn't get airsick. If she is going to be prone for motion sickness, this is going to weed it out. Be ready to cut this part short, if needed. Don't get too tied up in the accuracy of this practice maneuver. It is just an exercise to get the student doing her first "big maneuvering" with an airplane and learn good orientation. Don't spend too much time with it.

Now we're ready to talk about the first aerobatic maneuver, the aileron roll. There are many types of rolls including slow rolls, barrel rolls, snap rolls, and aileron rolls. They are distinctively different by what is happening to lift through the roll. So, for instance, when we say slow roll, we really are meaning a roll that is performed in level flight. This means that the whole time the aircraft is rolling, we are finding ways to develop enough lift to maintain a level altitude. Now that we have aircraft capable of a 400-plus degrees per second roll rate, the term "slow" might seem ludicrous, but this roll isn't required to be done quickly; it's one that requires maintaining altitude through the roll. This is in contrast to the aileron roll, a roll that disregards level flight. *[Editor's Note: The various types of rolls were comprehensively covered in the August issue in the article "A Roll Is a Roll Is a Roll" by Gordon Penner.]*

ZERO-LIFT ANGLE OF ATTACK RETURNS

Last time we spent a while discussing the zero-lift angle of attack. Now we are going to apply this angle of attack (AOA) to an actual maneuver. To keep it simple we are going to do aileron rolls on a parabolic arc. This eliminates not only the complex control movements required in the slow roll, but also the real nemesis of a roll, which is lift. Lift is the strong force produced by the wing to hold you up. Any attempt to roll an airplane will lead to

big trouble if we don't do something with lift. Tilt the wing over with some bank and lift will turn you. Bank a bit further and you really start noticing that lift isn't working against gravity any more. Roll over on your back and lift will pull you quickly and dramatically toward the ground!

So this is where we'll first experiment with zero-lift angle of attack. By pushing the stick forward until reaching this neutral AOA, we do two distinctive things: first, we neutralize all our lift, which transforms our airplane, with its sharp pointed end and light feathery end, into a giant lawn dart! Second, we find that at this AOA we also have balanced aileron drag and therefore don't need rudder to roll, hence the name aileron roll.

Now let's do this basic of all rolls in the Super Decathlon. First, like all aerobatic maneuvers, establish the correct airspeed. I like to see students in the Super Decathlon have 130 mph for this roll. After setting the correct airspeed, pull the nose briskly up a good 30 degrees to set a nice flight path for a parabolic arc. Then push the stick forward until you are weightless. Why? Because at the zero-lift AOA you are creating no lift, and when you are not creating resistance to gravity, you will not feel gravity! Don't watch the G-meter; look straight ahead and use you butt-meter. Push the stick forward until you are floating, and then, while keeping the elevator portion of your stick right there, move the stick ALL the way to the left.

Then freeze. If you have set the controls right, you now have full ailerons to roll the airplane at the zero-lift AOA, so there is no turning or diving. You are simply floating through an arc while the ailerons create the roll. And what did you do with the rudder? Nothing. There was no aileron drag, so you never moved the rudder. When the horizon comes back to level, return the stick to neutral and then pull the nose back up a bit (because by the end of the roll the arc has got you pointing a bit down).

THE "KOONTZ" AILERON ROLL AS A TEACHING TOOL

The aileron roll is not used in competition, so it is often described inconsistently. If it's not used in competition, then why are we learning it? We want the student to explore the zero-lift AOA and practice finding it. We want him to see the nose yaw from aileron drag and learn to use his butt-meter to find 0G.

Moving the stick to the side of the airplane to roll presents a challenge to maintain the zero-lift AOA. The student should make almost an L-shape with the stick. It will take a bit of coordination to move the stick to the left or right without changing the elevator position. This is where you will emphasis the butt-meter. One way to tell if the roll is being performed correctly is to "float" in the seat throughout the process. Another way to check if the ailerons were applied while maintaining zero lift is watching the nose. The nose should appear to lift up during the maneuver, and then as the stick moves forward and over to one side, the nose should appear to drop straight down as the airplane flies the arc. Some orbiting of the nose might be apparent, depending on the height of your student. That's because if he is sitting higher that the nose, the airplane is actually rolling around the center of the wing, causing a small orbit of the nose and the pilot's head during the roll. The nose should point straight ahead throughout the roll and should end on a point. Any yawing off heading is being caused by aileron drag and lift, which indicates an incorrect AOA! Don't correct any yaw with rudder. Correct it by returning to the right AOA. When you are there, the lawn dart will straighten itself out!

The aileron roll is a constant study of the relationship between aileron drag and angle of attack. As we have seen, ailerons create adverse yaw if applied while creating lift and a balanced drag only at the zero-lift AOA. Take time to clarify this, and let your student see it in action. He will then have a chance to nail this concept down and be able to use the information with less confusion later.

By teaching the aileron roll in this first lesson you have given your student an easy way to break into aerobatic flight. Do as many with him as you can. If he is doing well, do them to the right. If the "which way does aileron drag pull the nose?" question is still confusing him, then wait to do rolls to the right until the student understands the answer. You have also given him a simple tool to use to get out of many kinds of situations. In most out-of-control or aircraft-upset situations this is the best move. Remembering to do the simple L-shape with the stick may prevent the disastrous split-S by rolling the aircraft right-side-up instead. I call it the lawn dart recovery. Move it all to neutral and then roll to level. I have never been able to throw a lawn dart and make it tumble!

Basic air work, crazy-eights, and aileron rolls; this is the complete first lesson. If done at a comfortable pace, it should take nearly an hour of flying. On the ground, get the model plane and briefly go over what you did in the air with some emphasis on areas where you noticed some confusion.

In the next article, we examine lesson two of this four-flight basic aerobatic course. We'll do some refinements to the aileron roll and introduce loops. Until then, if you have any questions about aerobatic instruction or have some good ideas to share please, write to *greg@gkairshows.com*. We're always learning.

Greg Koontz is a NAFI Master Certificated Flight Instructor-Aerobatic and has been teaching basic aerobatic courses since 1974. He is a full-time aerobatic professional sponsored by American Champion Aircraft flying shows in his Super Decathlon, is an aerobatic competency evaluator (ACE), and is a member if the International Council of Air Shows' ACE Committee. Greg is a member of the National Association of Flight Instructors (NAFI) and actively supports its efforts to raise the standards for aerobatic instructors.