

USING THE RUDDER

WHAT TO DO WITH YOUR LEFT HAND WHILE HAVING A GREAT TIME WITH YOUR AIRPLANE.

While learning the basics of RC flying, most student pilots typically do very little with their left hand on the transmitter control sticks. Many student model pilots don't even keep their left hand on the left control stick. They reach for that left stick only when they must make throttle adjustments. And many times, they actually take their eyes off their aircraft to look down and find the left control stick. Much of their throttle control is of the on/off type. They add throttle for takeoff and flying and remove it for slow flight and landing. In between, the left stick is usually treated as a suspected pipe bomb.

But that left stick is there for a reason, just as rudder peddles are on every aircraft for a reason (*Ed. Note: yes, Bob knows about the Aircoupe, but most of those rudderless airplanes have been converted to rudder control over the years.*). The rudder is a vital control surface that must eventually be mastered. We won't get too technical this time; this article is about flying skills not aerodynamics. But we will throw out a teaser for you to think about now and then discuss it in a later article.

Except when performing aerobatic maneuvers, the rudder's *only function* in a conventional aircraft, not a canard, flying wing or other unusual design, *is to prevent unwanted turns*. The **vertical fin** provides directional and **yaw** stability, but the rudder is there only to keep the aircraft pointed correctly whenever it wants to deviate from the desired path.

That is why it is important for new model RC pilots to learn rudder control. Most high performance model aircraft tend to **snap roll** if too much elevator is applied at slow airspeeds. Proper rudder application prevents this dangerous condition. Larger aircraft, especially big **scale** models, first point in the opposite direction before swinging around and banking as ordered, called **adverse yaw**, when only ailerons are used in a turn. Proper rudder application prevents this unwanted yaw.

As airspeed drops, the ailerons lose effectiveness. Near **stalling** speeds, ailerons have very little effect at all. You have probably seen someone's scale or performance RC aircraft takeoff at too slow an airspeed, start to tip stall and roll to the left. The pilot applies opposite aileron but not much happens except the left bank increases even more (adverse yaw effect added to propeller torque). The pilot shouts "I ain't got it", the bank increases more and the plane cartwheels into the ground.

This unhappy event could have been avoided by using the rudder. The rudder is effective down to, and even below, stall speed. Opposite rudder would have compensated for the torque, prevented the tip stall roll and brought the aircraft back to level, climbing flight. If only the pilot had known how to use that dreaded left stick.

It is always best to learn rudder control from the very beginning. But most newer model pilots have not had that luxury. And honestly, learning the left stick at the very start does slow the entire learning process. Many new RC pilots would prefer not to have that delay. But there are fun ways to learn using the left stick that are effective and quick.

So how do we can learn to use both controls on that stick? We are going to entice you into learning rudder control by offering several easy and fun practice maneuvers and then finishing with the attractive, aerobatic performance known as a **stall turn**. Let's start with a fun maneuver using both rudder and throttle. I call it the 'tail wag'.

Start by flying a nice straight line (as all maneuvers are started) about 150-200 ft. high and parallel to the runway. Have the throttle set to about half. Just as you go past yourself (center) smoothly raise the throttle to full and let the airplane gain airspeed until it gets to full speed. Now the aircraft is past you and going fast. About 150 ft. past you, pull up to vertical flight. That's right, fly straight up. As soon as the aircraft is going straight up, start moving the rudder stick side to side—take about a half-second per side to do this. Continue until the airplane slows down and nearly stops in the air. At this point, push down elevator and resume level flight. Don't forget to then lower the throttle to about half and then make your normal turn back to yourself. Did you see the tail wag? Wasn't that great?

Do it again. Each pass does the same thing. Have fun. Now you are making the airplane do what you want! You are beginning to use the rudder and it's a ball.

Let's try something a little more complicated. If you do these things, pretty soon using the rudder will be just like using the ailerons. You'll be doing it automatically. So, on to the flat turn. *FLAT TURN, how the heck does an airplane turn flat? Everyone knows an airplane has to bank to turn. My instructor told me that when I was just starting out!*

Just relax and everything will be fine. Now that you are using the rudder, you can do more things with that beautiful trainer than your instructor ever told you.

FLAT TURNS

First establish a nice high and straight line parallel to the runway about 150 ft. high. *Where have I heard that before?* Just about all maneuvers start that way. Have the throttle set to about half. Just before the airplane gets to the center (right in front of you), raise the throttle to full. The airplane will gain speed. As the airplane gets to the center and is going fast, use the rudder to turn the airplane away from the runway. That is, if you're going from left to right give left rudder. If it's going from right to left, give right rudder. Slowly go to about half rudder—over about a second. The airplane will start to do two things at once, roll and turn. At this point you will give opposite aileron to prevent the roll. If you gave right rudder, give left aileron. If you gave left rudder you will give right aileron. Move the aileron stick just enough to keep the wings level.

To reiterate: Going left to right at full throttle; give about half left rudder and as the airplane starts to roll, apply right aileron to keep the wings level. The airplane will be turning but not banking. You will only see the yaw. On aerobatic airplanes, when you give rudder the airplane will do little or no banking. This rolling as you give rudder is called "roll coupling"; it has a lot to do with the amount of [dihedral](#) in the wing. As I said, this is not an aerodynamics column so I will not go into why. (*We need to leave the editor something to do!*)

Hey Bob, my airplane is turning without banking and I don't know what to do next. Sorry, didn't mean to leave you in that strange turn! Let's get you out of it. Once the aircraft has turned 90 degrees, just let the sticks go back to neutral. "Sticks" meaning both the right and left sticks. Please, don't just let go of the sticks; reposition them back to center keeping your hands on both sticks. That "*boing*" drives me crazy.

Practice this stuff and while you are practicing using the rudder don't forget to have fun. There is one problem you may run into while doing flat turns. After doing a 90 degree flat turn, you will no doubt want to do more; that is, a 180-degree turn or even a flat circle. These maneuvers are really great and very impressive. Do them but beware! The flat turn is a high drag maneuver. After all you are forcing the airplane to fly sidewise. This causes more drag and the airspeed goes down. The reduced airspeed reduces wing lift. Also, there is even less total wing lift because the inside wing in the flat turn is actually moving at a slower airspeed than the outside wing. Less and less lift

means you could run out of lift. Running out of lift means a stall. Now don't start worrying. You are nice and high; remember? If you do stall; reposition the rudder and aileron to neutral, raise the throttle a little and let the nose drop slightly). As you gain airspeed, apply a little up elevator and you will have full control as before.

All in all it's no big deal. Stalling is part of flying. Actually, there is no need to even go that far. With trainers you could do full rudder flat turns and multiple circles before you get into trouble.

(Ed note: Bob is being very sneaky here. Without telling you, what he has done is shown you how to learn flying the slip, or skid! This maneuver uses opposite (called "crossed") aileron and rudder inputs to rapidly lose altitude, without gaining airspeed, during landing approaches that are too high. Slips are also used to correct for wind drift while landing in a crosswind. You have to watch this man every second or he will be teaching you great flying techniques you never knew existed before you know what is happening! We'll try our best to warn you ahead of time, but he usually slips these stealth lessons by us as well.)

OK, now let's get to the really interesting stuff. We're going to combine all you have just learned and do an amazing maneuver that you have seen and admired ever since you have been coming to the field.

THE STALL TURN

By now, you know how to begin. That's right. 150 ft. high, straight and level, half throttle and parallel to the runway. As you pass the center of the field, apply full throttle and maintain heading at a high rate of speed. When you are about 150 ft. past center, apply full up elevator. Pull up to straight, vertical flight at full throttle. After you have gone a few airplane lengths and your airplane has slowed down, lower the throttle to about one third (keep it well above idle). Now, as your airplane slows down, apply full rudder in the direction away from the runway. After about a second, apply just enough opposite aileron to keep the plane from rolling. If you catch it just right your airplane will perform a vertical, flat turn within its own wingspan! Now you're heading straight down, so release the rudder and aileron, raise the throttle to about half and when you have gained some airspeed, pull out by giving up elevator.

One of the things that can go wrong with this maneuver is that the aircraft flops over onto its back or front. Recovery is the same. Keep full throttle on until the airplane is pointed straight down then reduce the throttle to half and pull out of the dive. Most likely you were going too slowly before inputting the rudder so the aircraft "flopped" out of the vertical turn. Apply rudder sooner or don't throttle down as much. If you still can't catch this maneuver you may want to talk to your instructor about increasing the throw of the rudder. Many trainers have very little rudder throw.

About the only other thing that can go wrong in a stall turn is that the aircraft's vertical path is not straight. Instead of going upwards in a straight line, the airplane's vertical flight path is pointing off to the left or right. Entering the maneuver, the first pull up, with the wings not level causes this. The vertical climb is then offset in the direction of the lower wing. Make sure the wings are level just before the first pull up.

You will also find that the wind will tend to cause the aircraft to drift in the vertical climb. For now, that is fine. Eventually, you will learn to compensate for this drift by pointing the fuselage gently into the wind during the vertical climb. Don't worry about it for now. HINT: Always try to stall turn into the wind. The rudder is more effective and turning into the wind recovers some of the ground lost to wind drift during the vertical climb.

You may not catch the stall turn with a first try. Try it again! Don't be afraid to go back to one of your instructors and ask for help. This can be a little tricky. But you WILL be able to do this within a couple of tries.

If you are using a more advanced sport aircraft for this maneuver, you will probably have less roll coupling with the use of the rudder. Less, or no, opposite aileron may be required.

At my club, we invite all soloed pilots to keep coming on 'novice' nights. There is plenty to learn after you solo. After all, we (as do most clubs) only require the most rudimentary maneuvers and take off and landing to solo. Most of your learning will take place after that big event. If you ever do stop learning—well, do me a favor KEEP LEARNING.