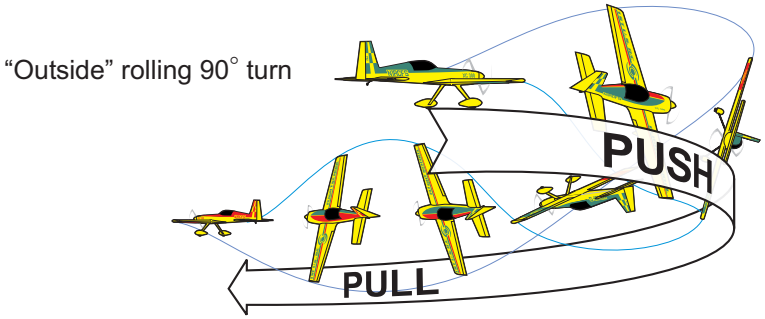
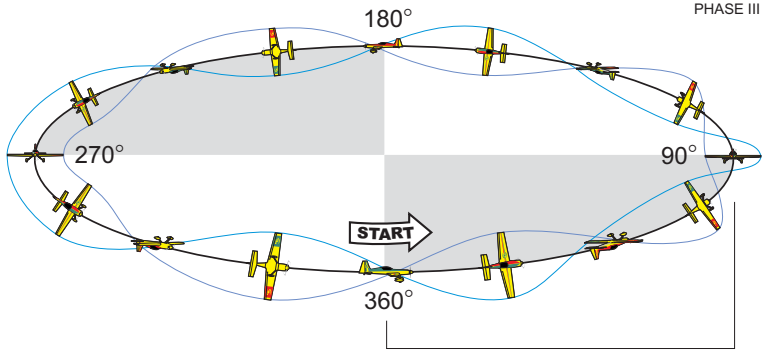
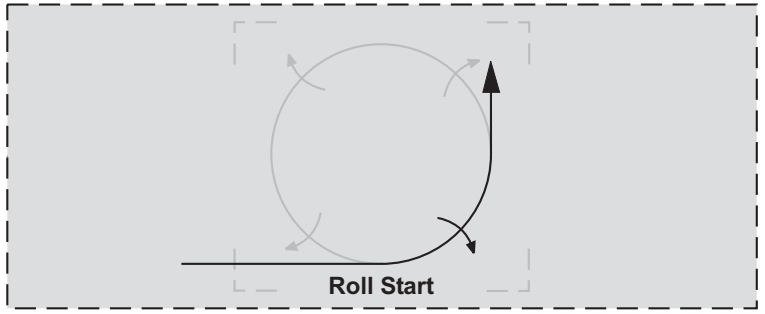
Rolling 90° Turn Prep

The best way to learn a rolling circle is to learn one 90° segment of a four-roll rolling 360, then repeating the process to accomplish a rolling 180, 270, and 360 will not be far off. The main objectives are to initiate and maintain a small aileron input to effect a slower roll rate (and time to react). As the wings approach knife-edge with the bottom of the plane facing the inside of the turn, smoothly push enough forward elevator to induce a turn. As the wings approach knife-edge with the top of the plane facing the inside of the turn, pull enough elevator to continue the turn.

Note 1. This program will feature rolling to the "outside" of the turn, due to the fact that most people find it easier to approach the end of each roll pulling elevator rather than pushing.







2. This is especially true when things start out amiss: Students find it more natural to salvage a turn pulling elevator as compared to pushing. When you set out to do an outside rolling left turn, roll the plane to the right. Your first elevator input will then be a push, and the next a pull.

Do not be too concerned initially with turning exactly 90°. The early goals are to be able to maintain a small aileron input and push and pull at the correct times. The next step will be to adjust the roll rate and the pace of the push and pull to manage the degree of turn.

Rolling 90° turns are most comfortable to fly with the plane positioned near the front of the aerobatic box and the turn performed going away from the pilot. This setup will then make room for the eventual rolling 360 as well.

It is also wise to enter the early attempts from a slight climb so that you can concentrate on using the elevator to effect the turn, not to recover!

KPTR: Climb slightly before initiating a slow right roll, then push the airplane into a left turn.

Rolling Turn

The periods when the wings are 45° and steeper is when the elevator is most effective at turning the plane, and therefore those are the key times to smoothly push and pull during the roll(s).

Three key elements effect a successful rolling turn: 1. A constant roll rate (aileron input). 2. Initiating the push and pull at the correct times. 3. A consistent elapsed time applying and taking out the elevator.

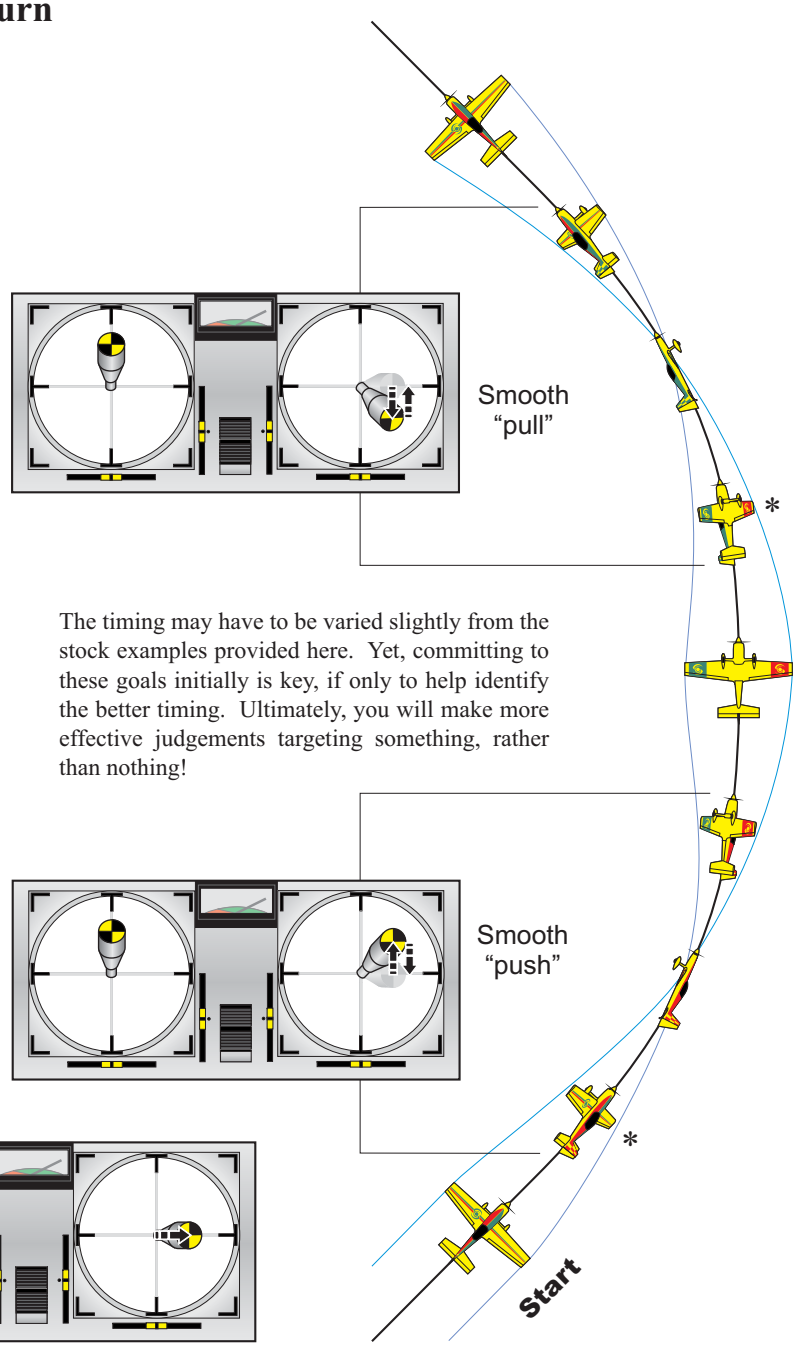
Roll rate: Maintaining the same roll rate is the result of a lot of practice, and helped by stiffer stick tension, a good grip on the transmitter, supporting your thumb with your index finger, and a direct correlation between control inputs and airplane response.

Timing*: Avoid applying any noticeable elevator before the wings reach 45° or you may force the plane into a descent. I.e., You will be well served to not input the push or pull until you **see** the wings banked past 45° / approaching knife-edge.

Elapsed time: To maintain a consistent elapsed time applying and taking out the elevator, you will be well served initially to pace the push and pull with the time it normally takes to say or think, "push" and "pull." By smoothly inputting the elevator at this pace, starting after 45°, the input should peak near knife-edge, when it is most effective, and be returned to neutral well before the wings approach level.

Almost all the common faults that occur at this point are the result of increasing the aileron and changing the roll rate, leading to an inability to manage the elevator properly. In that event, one is helped with further pre-flight preparation (see pg. iv: *Advanced Visualization*), more attention to the inputs, and using less aileron.

KPTR: The push and pull must be applied smoothly to avoid arriving at too much-too early, and forcing an altitude change.



The timing may have to be varied slightly from the stock examples provided here. Yet, committing to these goals initially is key, if only to help identify the better timing. Ultimately, you will make more effective judgements targeting something, rather than nothing!

Managing the Degree of Turn

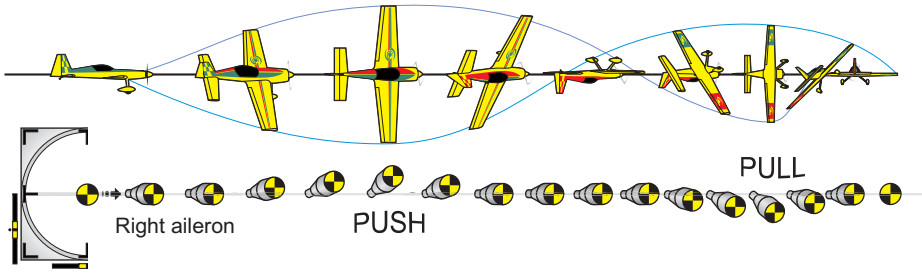
You need to realize that there is a direct correlation between the roll rate and the type of elevator inputs required to perform a one-roll rolling turn.

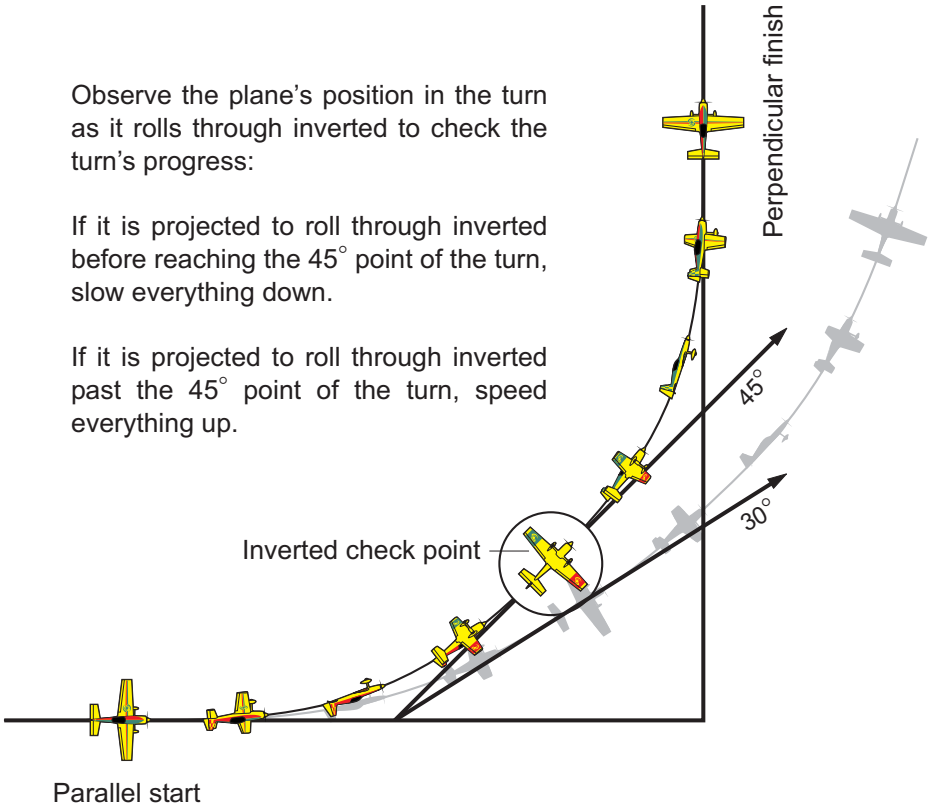
As a pilot advances, the goal becomes to complete one roll in a 90° turn. In other words, if started parallel with the runway, the targeted completion of the roll would be perpendicular to the runway.

At this point, the degree of turn is managed by the roll rate. For example, a slower roll rate results in longer periods with the airplane on its side, greater exposure to the push and pull phases, and thus more turn.

Consequently, if your one-roll rolling turn is completed, or projected to be completed, before reaching 90°, the roll rate has to be slowed down to buy more time to reach 90°. However, when you slow the roll rate, the pace of the elevator inputs also has to be slowed to correspond to the longer periods with the airplane on its side. (Larger elevator inputs can also induce more turn, but at a certain point, are prone to causing altitude changes as well!)

Note: The *pros* use the moment when the plane is inverted to check their turn's progress. They ultimately try to roll through inverted at the 45° (half way) point of the turn. If the plane arrives, or is projected to arrive, at inverted before reaching the half way point, everything has to be slowed down to keep from finishing the roll short of 90°. Should inverted be reached after 45°, everything will have to be sped up to keep from over-shooting the 90° point.

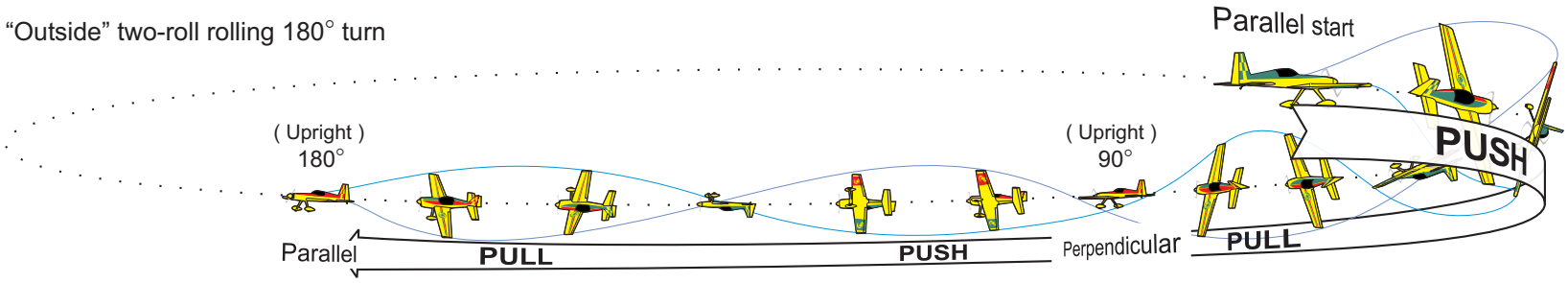




KPTR: If the roll looks like it will be completed shy of 90°, try to reduce and slow down all your inputs.

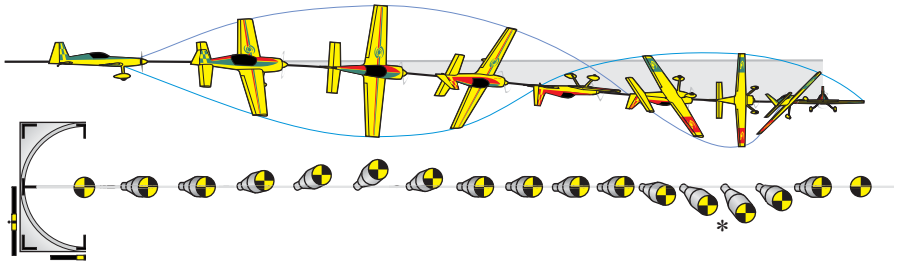
Level Rolling 180° Turn (Turnaround)

The interim step before attempting a rolling circle is to perform a two-roll rolling 180° turn. A rolling 180 is approached and flown as a rolling 90 to the cardinal point perpendicular to the runway, and then without hesitation, another rolling 90 to the next cardinal point parallel with the runway. A pilot able to perform a good rolling 90 should experience little additional challenge repeating the process to complete a 180. Other than targeting a new cardinal point to complete the second roll, the only notable difference is that altitude changes become more noticeable in multiple-roll rolling turns.



Question: What happens when the inputs applied to keep a slow roll level are not large enough? The obvious answer is that the roll loses altitude. Similarly, a loss of altitude during a rolling turn is corrected by increasing the size of your pushes and pulls. (Note that increasing the size of your elevator inputs will naturally extend the length of time that they are applied, which is what effects the recovery from a descent.)

If a climb is observed, lay off a bit on the size of your pushes and pulls. But remember, if you reduce the size of your elevator inputs, the turn will also widen, and therefore you will most likely need to reduce and slow down everything else to buy more time to reach the cardinal points.



If a descent is observed, increase* the size of the elevator pushes and pulls.

If a climb is observed, decrease the size and pace of all the inputs.

 KPTR: Recovering from a descent while rolling is accomplished by increasing the size of your pushes and pulls, and vice-versa.

Rolling Circle

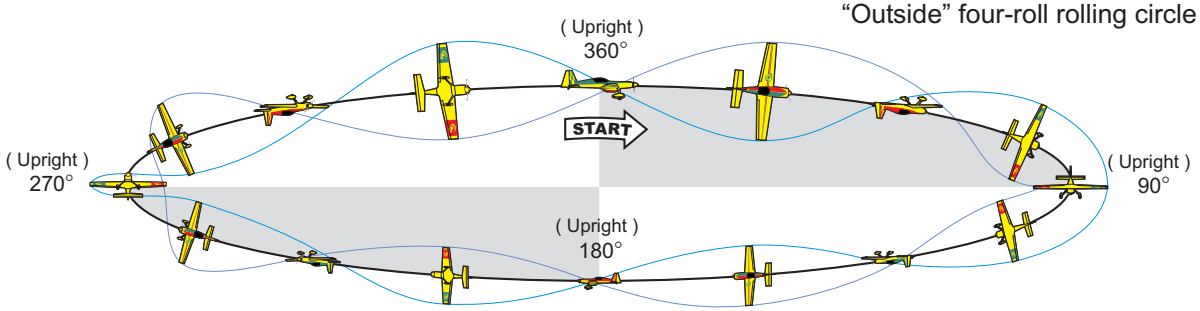
A full rolling circle at this point is comprised of four rolling 90° turns. The most challenging aspect of this rolling circle is completing the last 90° with the airplane turning toward the pilot. Thus, it is important to have developed some comfort with rolling turns prior to attempting a full circle, since you'll have to depend mostly on muscle memory to complete the last awkward turn.

Simplify the process of performing a four-roll rolling circle by thinking of it as a rolling 90, which is then repeated again, and again, and again.

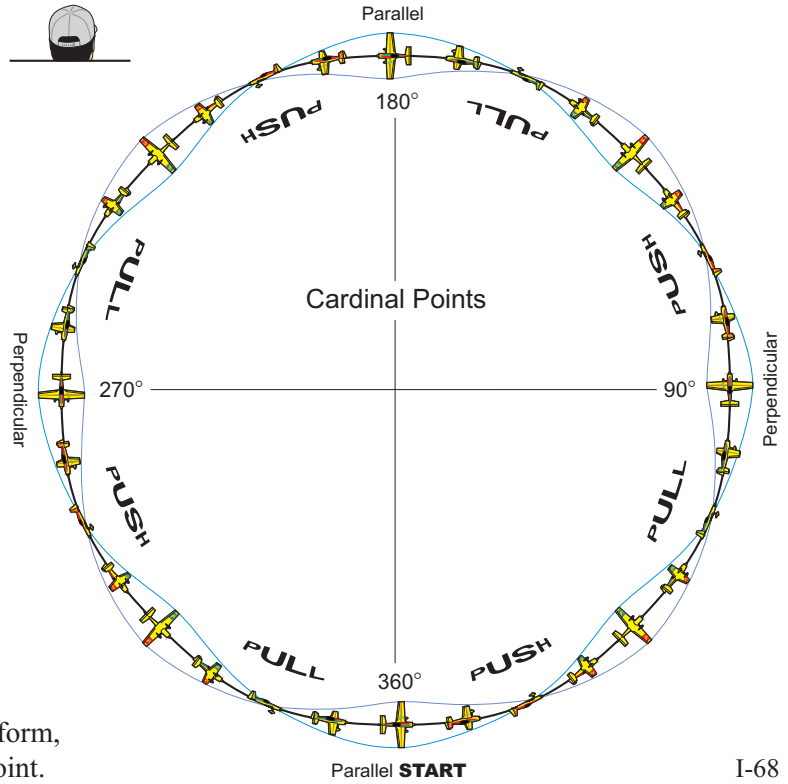
Side note: If you get the chance to observe an amateur aerobatic contest, you will see that, even at the competition level, very few flyers can complete a rolling turn! An investigation into why this is has revealed that many flyers avoid practicing rolling turns for fear of embarrassing themselves in front of other club members.

It has been said that "fear is your gut telling you that you need more information!" The best way to secure a good understanding that will enable you to make the most of every opportunity that you get to practice rolling turns is to thoroughly visualize rolling turns with a stick model until you are confident that you know what it takes.

"Outside" four-roll rolling circle



The common fault at this point is getting caught up in a rhythm pushing and pulling that results in inputting elevator before the airplane reaches the point that it is needed, thus forcing the plane into a descent. While anticipating inputs is better than reacting in most maneuvers, not in this one. Any change in the roll rate will throw off all the timing. So, while a rolling circle does have a certain rhythm to it, always watch the wings to trigger your elevator inputs.



KPTR: Instead of thinking about the multiple rolls you need to perform, keep confining your thoughts to rolling to the next 90° cardinal point.

Rolling Turn(s) w/Rudder

PHASE III

Introducing rudder into a rolling turn will help keep the turn's radius constant during the periods when the wings are level, and ensure that the nose does not drop through knife-edge. The best way to learn rudder in a rolling turn is to <u>first</u> master the right-hand stick! I.e., When one can manipulate the right stick without much thought, he can more effectively concentrate on applying the rudder correctly.

The luxury afforded a pilot learning to use rudder in a rolling turn is that the rudder is not nearly as influential as the elevator can be, and thus one is able to concentrate on the smoothness and timing of the rudder switches without having to be too concerned about applying too much.

Assuming that you will be adding rudder to an otherwise respectable "outside" rolling left turn, only the rudder inputs are featured in this example:

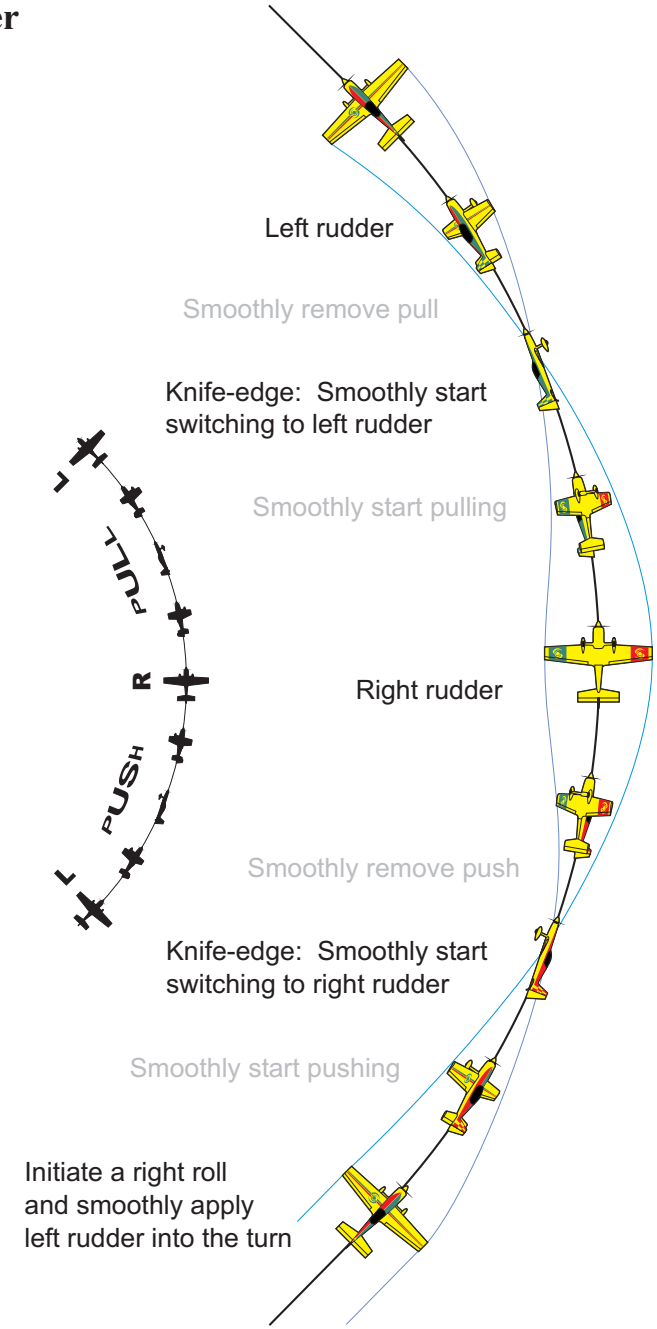
1. Simultaneously initiate a slow right roll and smoothly apply left rudder into the turn.
2. When the wings reach knife edge, start smoothly switching over to right rudder.
3. When the wings reach knife-edge again, start smoothly switching back to left rudder.

Altogether the sequence is:

Initiate and maintain a small right aileron input and, "**left**, **push**, **right**, **pull**, **left**." (That is, left rudder, then push forward elevator, then right rudder, then pull elevator, then left rudder. Repeat this sequence correctly three more times and you will perform a circle.)

Note that every input is applied, taken out, or switched <u>smoothly</u>! The only quick input is when the aileron is neutralized to complete the maneuver.

Side note: Anyone who attempts to introduce rudder while still learning to use the right stick will force his brain into an "either-or" decision, with the rudder control most likely drawing all attention away from the right stick — causing numerous failed attempts and certain discouragement.



KPTR: Start to smoothly switch the rudder each time the wings reach knife-edge.