Rolling Turns and Circles
Rolling Turns

Possibly the most challenging and admired maneuver in aerobatics is the rolling circle. In its final form, the pilot continuously manipulates all the controls in a rhythmic pattern that can be likened to stirring a pot with two separate spoons. Rolling circles can be performed from upright or inverted, and involve one to four rolls. The goal of this program will be to complete one upright slow roll every 90° of a 360° turn. Additionally, the airplane can be rolled in the same direction as the turn (“inside”) or opposite the direction of the turn (“outside”), or a combination of both. (Hey, if it were easy it wouldn’t be so impressive because everyone would be doing it – but for reasons not entirely having to do with pilot ability, few can!)

Most aerobatic maneuvers are the type that a knowledgeable pilot can achieve early success with by trusting his inputs. The role of hand-eye-coordination is primarily to detect the final touches to perform the maneuvers nearly perfect. What makes the rolling circle so challenging to learn is that it depends almost entirely on hand-eye-coordination from the start: This program will instruct you what to do, but the actual execution of a rolling circle is done reacting to the plane.

Most instructors teach rolling circles by emphasizing all the different control positions required, and what they understand to be the common mistakes. The student then has so many things to consider that it is no wonder why so few are able (or have any chance) to learn this maneuver. 1st U.S. R/C Flight School has been teaching rolling circles for years, and has developed a method for learning them based on the crawl-walk-run methodology. This method has proved many times to help advanced students complete their first rudimentary rolling circles in about an hour, and therefore motivate them to pursue even greater standards of performance. Mastering rolling circles, however, takes many hours of practice.

Let’s begin by noting that rudder in a rolling circle is a high-end refinement used mostly to keep the turn radius perfectly round. Since one has to be able to do a rolling turn before it can be refined, rudder should initially be left out of rolling turns in order to concentrate on the primary controls of aileron and elevator, and thus more quickly achieve some success to build upon. Then, when you are able to consistently achieve “7’s and 8’s” on the maneuver, rudder can be added for the “9” and perfect “10” attempts!

KPTR: The common-sense approach to rolling circles is not to concern yourself with refinements until you first achieve some success.
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*: You do not want to have any noticeable elevator applied before the wings reach 45°, or the plane may be forced into a descent. Thus, you will be well served not to input the push or pull until you see the wings at least 45°.

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 at 45°, the input should peak near knife-edge, when it is most effective, and be returned to neutral 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.
Managing the Degree of Turn

You need to realize that there will be a direct correlation between the roll rate and the type of elevator inputs required to perform a one-roll rolling turn exactly 90°.

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 will have 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 45°, 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 overshoing the 90° point.

Observe the plane’s position in the turn as it rolls through inverted to check the turn’s progress:

If it is projected to roll through inverted before reaching the 45° point of the turn, slow everything down.

If it is projected to roll through inverted past the 45° point of the turn, speed everything up.

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