

Chinook Winds RC Club Instructors Action Plan

2019 Wings Program (Sport Aerobatics)

PURPOSE OF THE PROGRAM

- 1 To provide an interesting and challenging flying achievement program that will encourage individual club members to improve their overall flying ability.
- 2 To develop a membership of competent flyers to assist new club members regarding all aspects of the sport that pertain to powered flight.
- 3 To minimize safety hazards and accidents by encouraging all club members to develop better and more proficient flying habits,
- 4 To make radio control flying a more meaningful and satisfying experience for all club members.
5. Sport Aerobatics are not competitive but rather intended to provide pilots with basic aerobatic skills and knowledge to allow them to progress in their area of interest in the future.

Aerobatic Plane Selection



Sport Aerobatic

- Constant-chord shoulder wing
- Symmetrical airfoil
- Minimal dihedral



Intermediate-Sport Aerobatic

- Constant-chord mid or low wing
- Symmetrical airfoil
- Minimal dihedral



Advanced Precision Aerobatic

- Tapered mid or low wing
- Symmetrical airfoil
- Minimal dihedral

Aerobatic Airplane Considerations

Precision aerobatics is unarguably the most engaging and rewarding forms of flying available to the R/C pilot. A key component in that pursuit is securing a “neutral” airplane that flies like it’s on rails and does only what you tell it to do.

Together with the physical size and travel of the control surfaces, how each model flies is primarily determined by the shape of the wing, the wing’s location on the fuselage, and balance. As you already know, an airplane’s wing generates the “lift” required to support the plane’s weight. A wing positioned on top of the fuselage places the lift support above the plane’s center of gravity (C.G.), resulting in an inherently more stable airplane that favors flying upright. Wing dihedral further enhances upright stability by angling the wing higher above the plane’s C.G.. While a high wing airplane with ailerons is capable of some aerobatics, it’s more of a struggle to do so. Mastering aerobatics is much easier with an airplane designed for aerobatics, or to be specific, one with a lower wing placement, a symmetrical airfoil, and little or no dihedral.

Mid and low wing airplanes, and most biplanes, with minimal dihedral locate the wing(s) closer to the plane’s C.G., and thus, combined with a symmetrical airfoil, are more “neutral”, i.e., prone to staying in the attitude the pilot puts it in. This type does not necessarily require any special flying skills, but since it is more maneuverable and will do whatever the pilot tells it to do, there’s less margin for error and therefore pilots must more accurately control this aircraft type.

Once you’ve graduated to a tapered wing airplane like an Extra, Edge, MX, Cap, Sukhoi, Yak, etc., they are all equally capable, and except for the size of the control surfaces, any differences that are not setup related are so minor as to be undetectable to all but the most expert flyers. The practical consideration when shopping for the ideal aerobatic airplane comes down to whether it features conventional (non-oversized) control surfaces that will provide smoother control responses better suited to precision flying. Or, does it feature oversized 3D control surfaces more suited to extreme maneuvers, but then also increasing sensitivity and making it harder to fly precisely. (You can be almost certain that an airplane has over-sized control surfaces when references to “3D” occur in its name or advertising. Of course, that means that nearly every aerobatic airplane available today has oversized surfaces!)

Lastly, flat-plate and thin airfoil “foamies” tend to be unstable and difficult to trim, and therefore require more effort to fly in general. Consequently, flat-plate airfoil foamies are not recommended for precision aerobatic training (although, they are perfect for 3D training). Thus, if you ever see a pilot flying a foamie smoothly, he’s no doubt, extremely skilled!

KPTR: Sport airplanes are easier to fly, but a tad harder to fly precisely.

Advanced airplanes offer more precise handling, but demand more attention.



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Sport Aerobatic Plane Set-Up

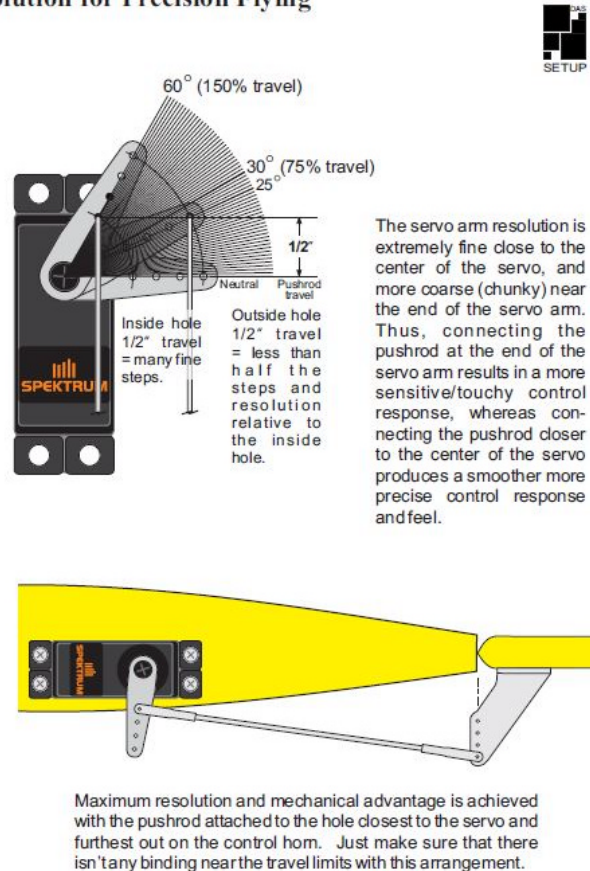
Generally deflections on all control surfaces are reduced on aerobatic planes to the deflection angles required to fly aerobatics which increases precision, maximize servo resolution, decreased possibility of blowback or flutter. It is unlikely that any surface will be required to move to an angle of 20 degrees and most much less so the servo arms can be selected on that basis (Short Servo ARMS).

Maximum Control Surface Resolution for Precision Flying

When possible, the ideal control hookup for smooth precision flying is to attach the pushrod to the hole closest to the center of the servo and the furthest out hole on the control horn to achieve maximum resolution and mechanical advantage (torque). Then, increase/decrease the radio percentages to achieve the recommended travel and ultimately the desired handling. If more travel is needed even after maxing the percentage in the radio, you'll have to sacrifice some resolution and mechanical advantage by moving out on the servo arm and/or closer to the control surface.

Explained: Servos are designed to move a certain number of incremental "steps" at 100% travel. Increasing and decreasing the travel percentage in the radio increases or decreases travel by adding or removing steps, yet the size of the steps remain the same. Connecting the pushrod closer to the center of the servo means that a higher travel percentage will have to be programmed into the radio due to the very small (fine) amount that each step is actually moving the pushrod, thus increasing the "resolution" of a given control surface travel.

On the other hand, achieving the same travel with the pushrod connected near the end of the servo arm will require a lower travel percentage in the radio, thus reducing resolution and causing a more coarse (abrupt) control surface movement for each incremental step that the servo arm moves. Of course, 3D pilots must sacrifice resolution in order to achieve the large travels necessary to perform extreme 3D stunts. Therefore, before attaching the pushrods, you'll have to decide whether the plane will be used primarily for 3D stunt flying or precision aerobatics. Once again, there's no in-the-middle and those who try to set up an airplane for both will end up with a plane that does neither as well as it could. While it's true that some exceptionally skilled pilots are able to fly precision with a 3D setup, it takes immense amounts of concentration and practice, with the slightest lapse in concentration immediately resulting in jerky flying.



KPTR: When set up for maximum resolution, the control response is much smoother

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Transmitter Set-Up

All surfaces should be set-up using Mode Control and dual or triple rates or preferred is the use of Conditions if the transmitter is capable. Most aerobatic planes require the following deflections:

Elevator – 8 to 12 degrees, Aileron 12-15 degrees, Rudder 20 – 40 degrees

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CW Pilot Development Process

- > All trainees entering Level “A” are required to fly a trainer style plane.
- > All pilots in higher levels (B thru D) should have an aerobatic plane.
- > It's highly recommended that all aerobatic planes have completed the Aerobatic Trimming process recommended by Peter Goldsmith or equivalent plus we need to add a high speed stall maneuver to determine the planes reaction before it gets pointed at the ground.
- > Historically trainees and pilots developing their skills always believe they know how to move the sticks to make a maneuver happen, frequently they do not so we need to ask them to fly the maneuver on the ground using their transmitters while the instructor verify the stick movements.
- > Pilots may attempt aerobatics with planes not ideally suited to aerobatics for whatever reason and above transmitter and dialog review will ensure the pilots knowledge and stick movements are correct so the flight that may not be perfect but will be safe.
- > Whenever a new maneuver is attempted if possible it should be done on an up line for safety and we must ensure there is a plan “B” if the maneuver does not go as planned.
- > Pilots must be aware that no matter what the situation is they should never stop flying.
- > Pilot development beyond Level “A” will occur using an adult development model not a school training model for ease and speed of learning. Adults learn best in this model.
- > Pilot Development is maximized when it 25% practice time and 75% visualization of the flight, use of the simulator. It's not only the amount of practice that is important but the quality of the practice. We must not be practicing errors.
- > Currently there are a few pilots that could use a refresher on level training and if they ask, it should be encouraged.
- > Pilots who start this program will find that they will start to see flight deviations of their plane sooner and will start to anticipate the inputs required to make it look smooth. Remember the goal is to be smooth so if you can see the deviation, so can everyone.
- > Pilots will be encouraged and taught how to progress from a reactor pilot that needs to see a deviation before input is applied to a pilot that anticipates the planes reaction and provides the inputs in advance. Go from Reaction mode to Anticipation Mode.
- > All aerobatic maneuvers must start from a flat and level flight path parallel to the runway with wings level. If this is not the case do not start the aerobatic maneuver. It is said that 90% of aerobatics is the setup prior to the maneuver, the wings must be level before entry or it will not look good and may not be safe.

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- > All aerobatic maneuvers are wind corrected.
- > Many inexperienced aerobatic pilots fly too fast and too close to themselves increasing stress and giving a rushed impression.
- > When we discuss **Sequencing** in the context of aerobatics we mean that the controls input must be Neutralized before the next input.

Instructor Wings Program Involvement

- > Instructors of the correct levels may be asked to participate in the training and testing of pilots. Therefore it could be developing pilots will have a number of instructors as they move through the program

Adult Development System

Generally adults like to get all the information on a subject all at once not divided into small sections that are not complete but will be added to over time. Skills needed in level "A" will be covered in detail for that level such as skills like take off, landing, wings level, flat level flight, etc. however skills for the other levels will be covered by individual aerobatic elements i.e. all loops, rolls, spins will cover all the info in each for all levels. This is however just scratching the surface and there is much more to learn if the pilots are interested. If you want more information on these topics just ask there is a lot more available.

Pilot Level "A" Details

Detailed Information on Specific Maneuvers

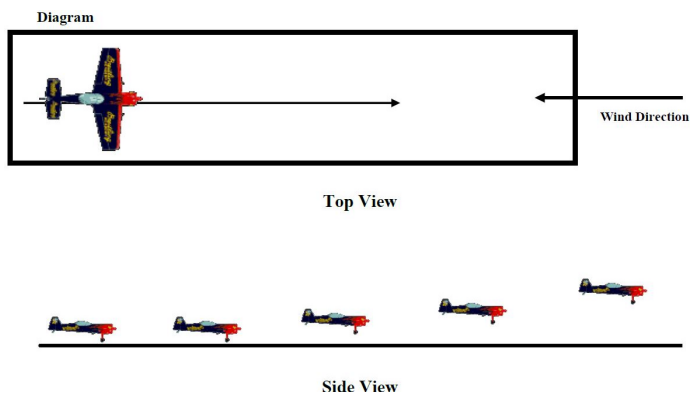
> Take Off

- o Take off must be down the center of the runway and include a gradual and steady lift off
- o Take off is affected by P Factor, Swirling wind from the prop and engine torque all of which tend to turn the plane to the left and are both speed and load sensitive. Most planes have an engine firewall that is angled to the right to compensate for these factors but a fully trimmed plane will still normally turn left on takeoff and whenever the elevator is pulled during flight to go up - right rudder must be applied and it increases as the plane slows on an up line or loop and the engine load increases.
- o Slight up elevator should be pulled before rollout to about 1/3 to 1/2 during the rollout (this will depend on the plane and how much elevator deflection is programmed in the transmitter) then released when the desired climb out angle is attained. Think of it as just squeezing up elevator

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until lift off. Pulling too hard on the elevator could result in a stall due to the plane lifting off without adequate air speed.

- o Abruptly pulling the elevator at any time will cause one wing to stall and result in a snap roll and on takeoff there is no time to correct a snap.
- o On a crosswind takeoff the same procedure is used except the wing facing the wind is kept 2 degrees low and the plane is kept on the center line using the rudder. In wind, the plane should be flown on the ground the same as in the air to ensure control.
- o Note: P Factor affects all maneuvers requiring the input of up elevator so right rudder bumps on all pull maneuvers.



Parallel, Flat and Wings Level Flight

Parallel, Flat and Wings Level flight occurs between all aerobatic elements and is very difficult to perform well in all attitudes so be sure to practice this a lot and add it to your pre aerobatic element check list to ensure its right since it cannot be corrected once the aerobatic element is started.

- > Aerobatic pilots typically only use turns to set up the desired flight line. Once the flight line is established they use Reverse $\frac{1}{2}$ Cuban 8s or $\frac{1}{2}$ Cuban 8's as turnaround maneuvers so they do not lose the parallel line to the runway.

If you have ever watched *proficient* R/C pilots fly (you can tell by their ability to perform a variety of maneuvers one after another), you may have noted the absence of any visible corrections or realignments between their maneuvers (often referred to as being *smooth*). The primary reason for their smooth and apparent ease of flying is so simple that it is often overlooked. The tendency of beginning aerobatic pilots, and frankly most flyers, is to start each maneuver and *then* try to make corrections to finish it on a decent heading. Proficient flyers understand that starting each maneuver from a parallel line is the most influential factor in finishing it parallel. Similarly, by having your priorities straight and establishing good parallel lines early, you will have set the stage to be able to anticipate your maneuvers, learn new ones, and perform more than one per pass — just like a pro!

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- > A good exercise to practice parallel, flat, wings level flight is to complete a turnaround maneuver at each end of a straight flight line such as a stall turn or ½ Cuban and once the turnaround is complete do not touch the rudder or aileron until the plane get to the other end of the field. Learn how to set up a plane for straight parallel flight during these turnaround maneuvers. Once you get it so you can consistently fly without corrections add a cross wind (7 to 15 mph) and start using the rudder for corrections. Just bump the rudder to make the corrections smooth.
- > The final check before starting any maneuver is to ensure your wings are level. Practice wings level checks while flat, vertical, inverted, etc. they all look different.

Sustained Level Flight Setup

It is important to *sustain* level flight prior to initiating a loop in order to keep up the flying speed needed to fly through the entire maneuver. A tendency early on to let the plane *creep* higher prior to a maneuver may cause the plane to fall out of the loop due to its diminished airspeed — and could possibly cause you to mis-diagnose this as having made an error in the loop itself.

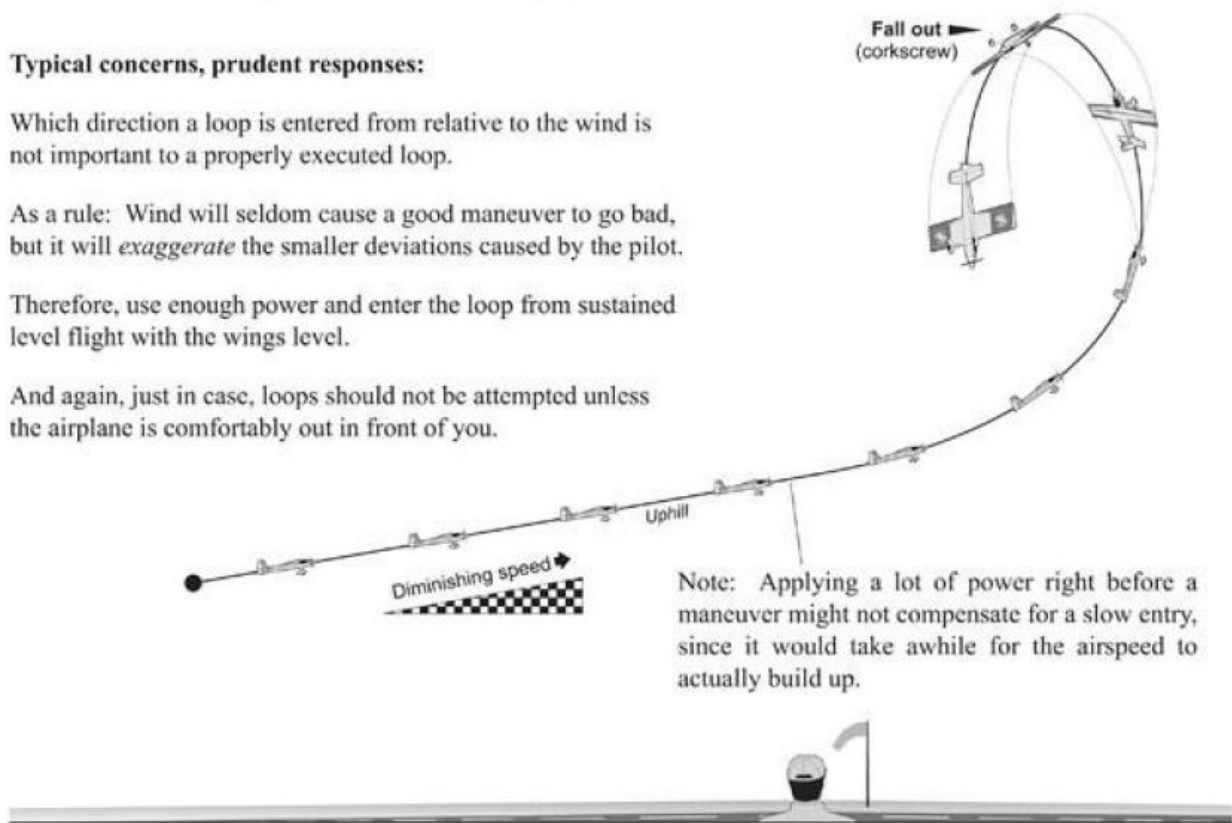
Typical concerns, prudent responses:

Which direction a loop is entered from relative to the wind is not important to a properly executed loop.

As a rule: Wind will seldom cause a good maneuver to go bad, but it will *exaggerate* the smaller deviations caused by the pilot.

Therefore, use enough power and enter the loop from sustained level flight with the wings level.

And again, just in case, loops should not be attempted unless the airplane is comfortably out in front of you.

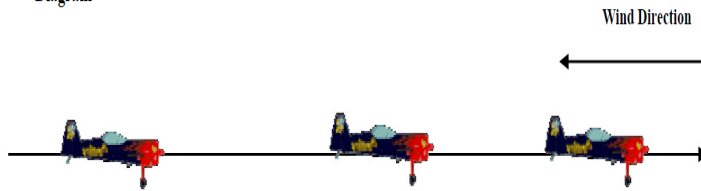


KPTR: To overcome gravity at the start of a loop, level flight above half throttle needs to be sustained leading up to it.

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Diagram



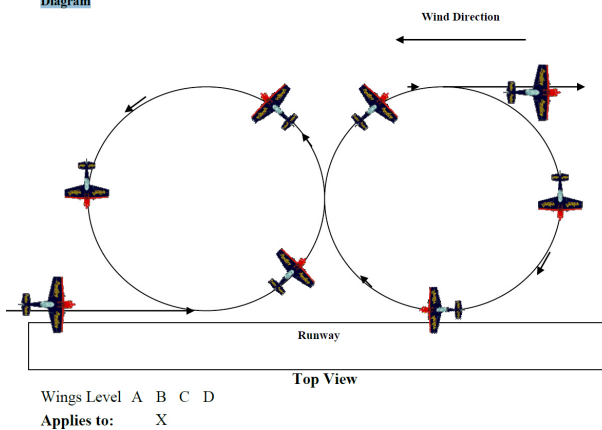
Side View

Flat Figure 8's

This figure will be added to the "A" level test for new pilots. Set up parallel, Flat with the wings level and directly in front of the pilot complete two flat circles intersecting in front of the pilot. The wings must not be banked more than 45 degrees and the altitude must remain the same throughout the maneuver.

Flat Figure 8

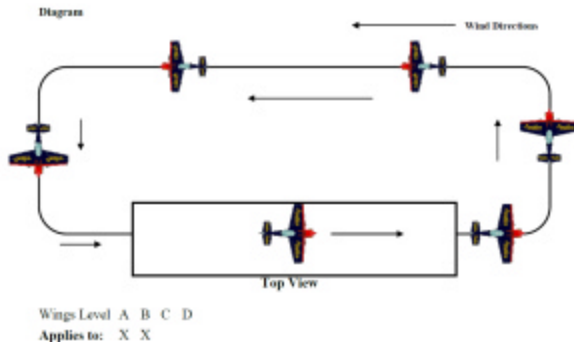
Diagram



Rectangle Approach

This is used to practice landing line up with runway centre. Ensure pilot are dead centre of the runway and that turns are 90 degrees at each corner.

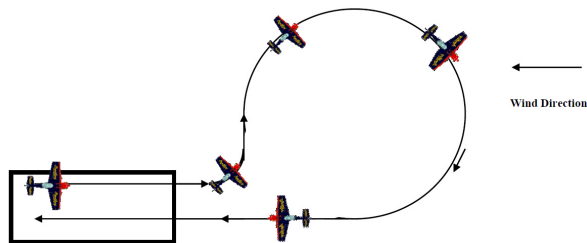
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Procedure Turn

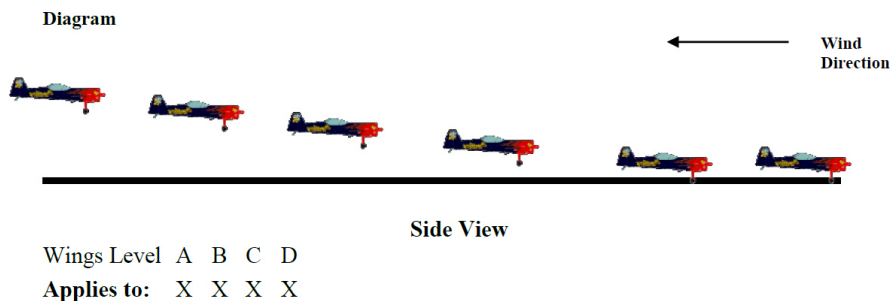
After the Straight Flight Out, model makes a 90 degree turn away from the flight line followed by a 270 degree turn in the opposite direction back to the reverse flight path of the Straight Flight Out.

Procedure Turns are used to teach new pilots to land and starts about 20 feet high until the pilot is ready to attempt landing. The Procedure is done from both directions.



Landing

The maneuver starts when the aircraft descends to two meters above the ground. The model flares smoothly to touch the ground and rolls to a stop with no bouncing or changes in heading. With most models the flare is simply a leveling of the decent, most are so light that if a flare is performed the plane will go up and perhaps stall. Any abrupt pull on the elevator can and will stall a wing usually resulting in a crash. Most times the pilot will say it was a radio problem because they lost control. Loss of control is what happens when a wing is stalled.



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Pilot Level B,C,D Maneuver Details by Family

Loops

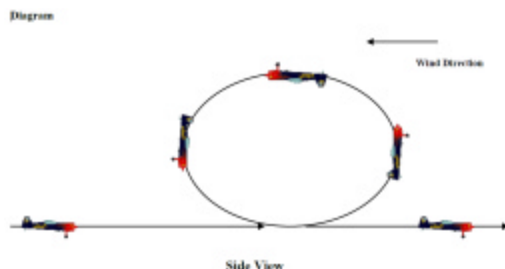
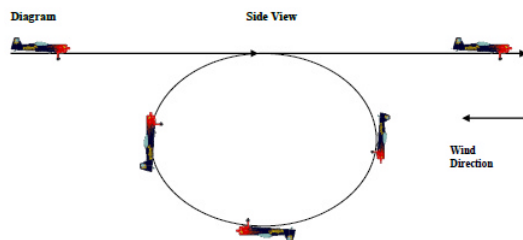
All loops that will be covered in this section are Sport Aerobatic Level Loops, they are all performed much the same these include but are not limited to inside loops, outside loops, inside/outside loops, outside/inside loops either started at the bottom or top of the loop.

Loops done correctly are 90% setup – parallel to the runway, flat approach and most importantly WINGS LEVEL. At the start of the loop, pick a point on the horizon or a cloud as a mark and ensure you finish the loop at that level. Then pull or push the elevator smoothly to a point that produces the size of loop you want and hold it steady until the loop is complete. On the down side of the loop reduce the throttle till near bottom then increase the throttle to cruise level. Exit from the loop should be parallel, flat and wings level same as the entry altitude. Most well trimmed planes will tend to need some right rudder during the loop so it doesn't become a cork screw maneuver. To little rudder is better than to much.

The pilot may wish to do a roll on top instead of 2 loops or a snap instead of 3 loops and this is ok but they must be contoured to the loop diameter and the pilot must sequence the maneuver (neutralize the sticks) before the roll starts or it will become a barrel roll.

Loops can be of any size limited by power and aircraft design.

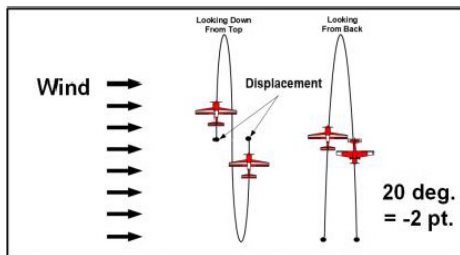
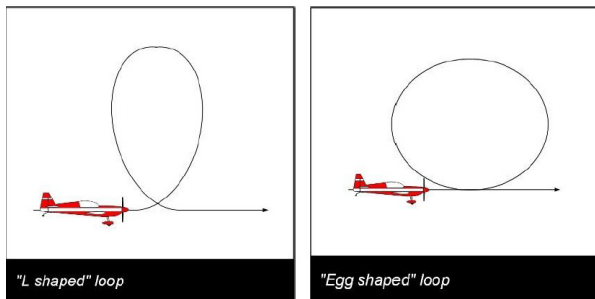
Some loops start from an inverted setup and proceed as a normal loop while others can start at the top of the loop and go downward. There is a tendency for pilots to pinch the bottom of an outside down loop as they see the ground getting closer. If you are sure that you have enough altitude resist and continue to complete the round loop. On a push loop left rudder bumps are frequently required.



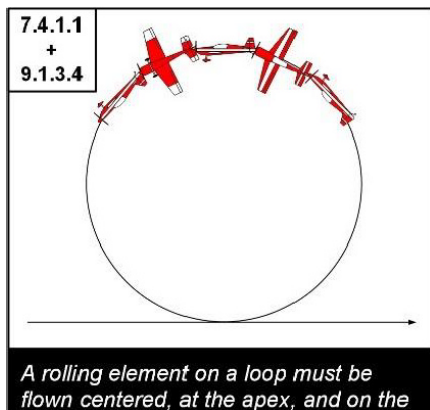
Wings Level A B C D
Applies to: X

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Loop downgrades



Loop with roll



Horizontal Rolls

Horizontal Rolls can take many forms from a single roll, $\frac{3}{4}$ rolls, $\frac{1}{2}$ rolls, $\frac{1}{4}$ rolls, $\frac{1}{8}$ rolls in and multiples of these rolls continuous and point rolls. Single rolls are frequently center field elements but can be added to just about any maneuver. They are not turnaround maneuvers.

Roll rate is typically 360 degrees per second for normal flying but slow rolls are much slower and require rudder input during the roll and elevator. Point Rolls require that the plane stops rolling at the indicated intervals and may also require rudder and elevator inputs.

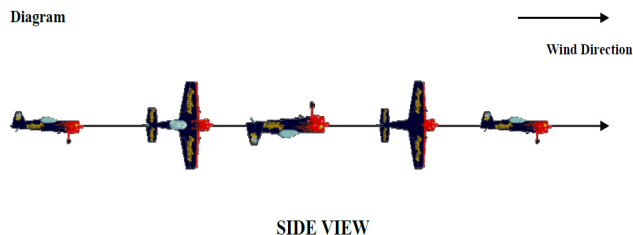
SETUP – parallel, flat, and wings level. Proper setup is the key to a good roll.

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At 75% speed, bump the elevator up, sequence the sticks, input aileron to complete exactly a 360 degree roll. All rolls must be axial along a straight line.

Some pilots like rolls to be very fast and while it may look good the roll is hard to stop at exactly the correct point. Points lost.

The 4 point roll look exactly the same but there is a hesitation where the plane stops rolling every 90 degrees then continues. Depending on the airframe and speed there may be a need for a same direction bump in rudder and push elevator bump when inverted plus an opposite direction rudder bump when rotating from inverted.



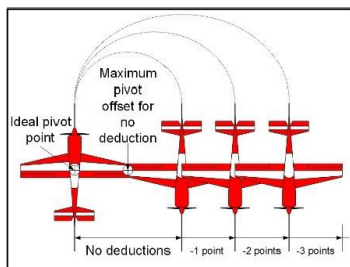
Stall Turn or Hammerhead

The diagram below is showing a wingover not a stall or hammerhead turn. A stall turn requires the same setup – parallel, flat, and wings level at full throttle to ensure when the plane is pulled to vertical that it is going straight vertical. Most planes will need some right rudder to keep the line vertical. The vertical line is maintained to the desired altitude and the throttle is slowly decreased allowing the plane to slow down until it stops with some throttle still on ensuring a good air flow over the control surfaces then full rudder is applied turning the plane into the wind if there is wind while decreasing the throttle to idle once the hammer is complete and provide a bump of right aileron to compensate for engine torque while stalled. You always add right aileron independent of which direction the hammer occurs. Hold the rudder in until the plane is heading straight down and slowly release the rudder then, sequence, then immediately correct the down line to ensure it is completely vertical. Hold vertical until the plane reaches the same altitude as it started at then pull to exit parallel, flat, with wings level at cruise throttle settings.

These turns are good turn around maneuvers and allow practicing parallel, flat, wings level flight without the use of rudder to get familiar with the required setup without adjustment for the length of the field.

At higher levels of aerobatics the radius of the $\frac{1}{4}$ loop to vertical and the $\frac{1}{4}$ loop on exit must be the same.

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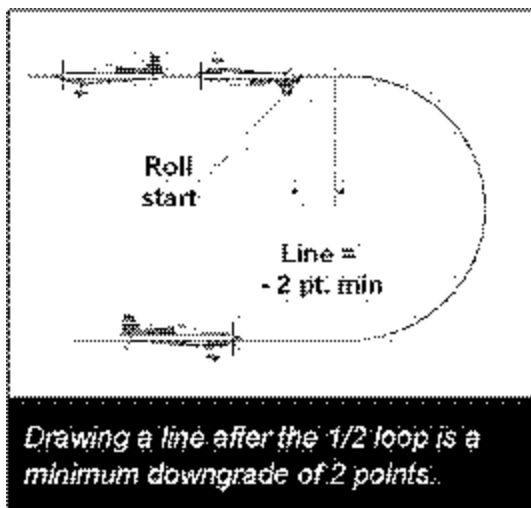


Half Loops

Half loops can either start at the bottom known as an Immelmann or a Split "S" if started from the top. Either can be push or pull loops and can have any number of additions added.

Immelmann

Immelmann is a turnaround maneuver and will normally be flown at the ends of the field. The entry setup is the same as an inside loop – parallel, Flat, wings level at a high throttle setting. Pull and hold the elevator to make the size of half loop desired, once at the top of the half loop, sequence the sticks, then immediately complete a half roll to parallel, flat, wings level at cruise throttle setting.



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Split "S"

From altitude with the same setup as above but at a lower throttle setting complete a half roll to inverted and slowly decrease the throttle setting while pulling the elevator to get the size of loop desired. Continue the loop to the starting altitude and exit parallel, flat, wings level at a cruise throttle setting. There is a tendency for pilots to pinch the back part of this half loop as the plane is heading for the ground so make sure you have adequate altitude at the start.

Inverted Flight

When inverted remember push, push, push. Well balanced planes will normally need a slight amount of push continuously on the elevator while inverted for flat level flight. The ailerons will work the same while inverted but the elevator and rudder are reversed. Push on the elevator to maintain level flight. When the plane is upright we always fly the nose of the plane pointing it where we want the plane to go, however when inverted at good tip is to fly the tail of the plane pushing the nose with the rudder inputs.

Practice inverted flight at altitude so if things aren't going well just roll upright. Rolling upright is always plan "B".

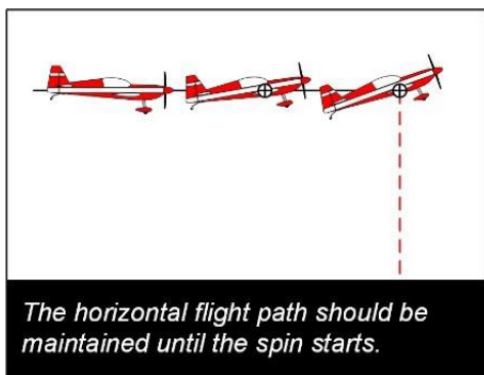


Spins

Spins may be positive (entered from upright flight) or negative (entered from inverted) other than that all spins are the same. The number of spin rotations or segments may be different as well.

When the aircraft stalls, the nose will fall and at the same time a wing tip will drop in the direction of the spin initiating autorotation. The fall of the nose and the drop of the wing are to occur simultaneously. Failure to achieve this is to be considered a "late entry" and is to be downgraded. After completion of the prescribed number of turns, the aircraft must stop rotating precisely on the prescribed heading and then a wind corrected vertical down line must be shown. Because there is no vertical line before the spin, there is no criterion to center a roll element that follows the spin on the vertical down line. No account is to be taken of the pitch attitude of the aircraft during autorotation, as some aircraft spin in a nearly vertical pitch attitude while others may spin in a somewhat flat attitude. Given these varying attitudes some aircraft may require a visible downward movement in order to set the aircraft into position to fly the required vertical downline after completion of autorotation. No downgrade is to be applied for this downward nose movement. Also, the speed of autorotation is not a judging criterion.

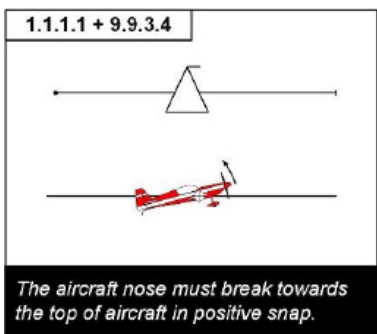
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As a spin is approached consider there is a dot on the fuselage of the plane and fly the dot not the plane as the plane slows the nose will need to come up to hold a horizontal line. Most pilots continue to let the plane slow until they have pulled about half of the elevator travel then pull fast last half of the elevator travel to get an abrupt nose bump and as the plane stalls into autorotation, in addition to full elevator also add full rudder and aileron. Autorotation is a condition where you have lost control while the pilot continues to hold the stick at full deflection and the autorotation will continue for a short period once the sticks are neutralized. With practice you will be able to judge how soon to release the sticks before the desired number of rotations so it will stop at the correct spot. Immediately push the nose of the plane down so it's exactly vertical. Increase the throttle to cruise and pull parallel, flat and wings level at the starting altitude.

Snap Rolls ("Flick Rolls) Optional not part of Wings

I have added this to ensure pilots understand the danger to planes inadvertent snap rolls can be. Snap Rolls can be positive (pitch to the canopy) or negative (pitch to the wheels). The diagram shows a positive snap starting.



Two essential components of snaps must occur 1. Pitch Departure – the aircraft must display a clearly visible change in pitch attitude in the proper direction. 2 Autorotation simultaneously with pitch departure. Autorotation involves an imbalance of the wings where one wing is stalled. Once the snap is completed the plane course can be corrected without penalty.

Snap speed is dependant on a number of factors which seem to be counter intuitive. To speed up a snap the deflection on both the elevator and rudder are **decreased** and the ailerons deflection is **increased**. A

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snap is started by pulling or pushing (if inverted) an abrupt change on the elevator causing one wing to stall. If there is only small amounts of rudder and or aileron with the elevator pull or push the plane will snap very fast.

Statistically 90% of all RC plane crashes occur on the last turn lining up with the runway for landing. When the plane is at reduced power making the last turn, if its starts to loose altitude more than the pilot may like the first response may be to pull a little elevator during the turn. This can lead to a snap related crash. In reviewing the incident with the pilot they say “the transmitter lost connection with the plane and I could make no changes” then the crash. Clearly autorotation means you have lost control and the only way to regain control is to neutralize the sticks. If your plane is low its too late.

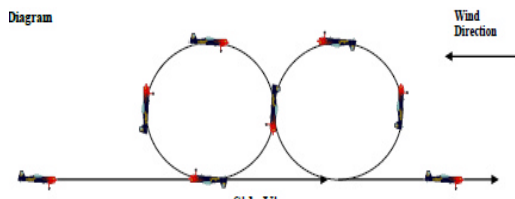
On take off not yet up to flying speed if you pull on the elevator abruptly to get the plane off the ground, it may snap. The pilot will say “ it would not respond to the transmitter” that’s because it snapped.

On landing if the pilot pulls abruptly on the elevator to flare there will be another discussion where the pilots say” the plane did not respond to the transmitter. It snapped.

Done intentionally with correct inputs snaps are fun and easy to control but to practice and get familiar do the snaps on a slight up line until your comfortable and can predict the outcome. Altitude is your friend in this case.

Horizontal Eight

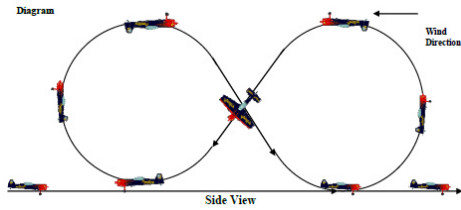
From a normal setup parallel, flat, with wings level advance the throttle to 75% or more pull a $\frac{3}{4}$ inside loop adding right rudder bumps to a 45 degree downline while cutting the throttle to 25%, push the same amount and complete full out side loop adding throttle to 100% at the loop bottom and bumping in left rudder and reducing the throttle as plane come over the top of the loop, when the plane completes the full loop it will be pointed straight down so pull the same amount of elevator to exit at the same altitude, parallel, flat, wings level at cruise throttle setting.



Cuban Eight

From parallel, flat, wings level flight advance the throttle to 75% and pull a $\frac{3}{4}$ loop to a 45 degree down line reducing the throttle to 25% and at mid downline push a elevator bump sequence and roll upright. Advance the throttle and pull another $\frac{3}{4}$ loop to an inverted 45 degree down line, push an elevator bump, sequence and roll upright, advance the throttle to cruise speed and exit parallel, flat and wings level.

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Pilot Testing

Pilots are required to have a caller during testing who will call the element for the pilot and judges. The pilot can fly the required elements in any order they wish so they should consider the **Geometry** of the program they are about to fly since they want it to look good and also not use more than the two trim passes allowed.

Conclusion

This is the start of Sport aerobatics and is not intended to replace the Wings program but rather provide additional details on how to maximize practice time and be successful at aerobatics. There is so much more that its hard to know where to start so if you wish more just ask.

I highly recommend David Scott's Manuals on aerobatic. It's the best investment a pilot can make in my opinion. He started the 1st RC school and is both a full size and RC aerobatic pilot. Here is the address:

<https://www.rcflightsschool.com/C/1/TrainingManuals>

Rick