Stall Turn / Vertical Piro

One of the easiest and most useful aerobatic maneuvers is a simple 180 degree piro atop a vertical line or “stall turn”. Basic stall turns are primarily used to turnaround after flying to your left or right and are most impressive when the pivot is performed atop perfectly vertical up and downlines.

Start by tilting the heli forward and adding positive collective to build forward speed, then use the elevator, aileron, and rudder to keep the heli straight and level. How fast the heli is flying when you pull up will determine how high and long the upline will be. Thus, you’ll need to establish a reasonably high entry speed into the upline to achieve sufficient altitude to perform the pirouette and subsequent downline without feeling rushed.

Note that the rotor disk must be level and the body straight when pulling up or else the heli will veer off to the side and complicate the remainder of the maneuver. The pull up should be smooth, but deliberate, in order to establish the upline before losing too much speed. The key to a good upline is to simultaneously neutralize the elevator and center the collective (zero thrust) at the exact instant the heli is pointing straight up. Then initiate a left or right rudder 180 degree piro as the heli comes to a stop atop the upline. Aim to stop the piro with the nose pointing straight down, briefly maintain a vertical downline, then simultaneously pull out while adding positive collective to fly away level.

The most overlooked segment of a stall turn is the downline after the pivot. This is where better pilots have a chance to distinguish themselves by flying straight down before pulling out. It’s common for rookie pilots to prematurely apply elevator pressure and/or collective in anticipation of the pullout, i.e., “cheat the pull”. However, flying perfectly straight down doesn’t require any particular skill, other than taking the initiative to make certain that the collective is centered. If there isn’t time to demonstrate much of a downline after the piro, start entering the maneuver faster to reach a greater height. A faster entry also gives you the option to perform 1½ piros at the top of the upline, a.k.a., a vertical “540”.

Another sensational version of the maneuver consists of starting multiple piros while momentum is still carrying the heli upward and continuing to piro into the downline. Just make sure that you don’t wait until the last moment to stop pirouetting, but leave enough time to reestablish your bearings and straighten the body prior to pulling out.

C-43       KPTR: Perfectly center the collective (zero thrust) to help ensure that the up and downlines remain perfectly vertical.
Loops

A basic loop shares a lot in common with a stall turn, such as its size and height are largely influenced by the entry speed, and success hinges on entering the loop with the rotor disk level and the body straight to ensure that the loop doesn’t deviate off to one side.

Start by tilting the heli forward and adding positive collective to build speed. Initiate the loop by simultaneously pulling up elevator and adding more positive collective. The pull itself needs to be smooth, yet also deliberate, in order to establish a consistent loop radius right away (hunting or trying to slowly finesse the elevator at the start produces loops that are both inconsistent and prone to running out of speed).

In addition to entry speed, the size of each loop is largely determined by the amount of elevator you hold in, i.e., a larger elevator input produces a tighter loop, and vice-versa. The elevator then remains locked in throughout the loop, but the collective must be centered or pulled past center to provide some negative thrust during the inverted portion of the loop to prevent the heli from rapidly falling. Positive collective is then gradually reintroduced on the backside of the loop to match the backside radius to the front side. Finally, neutralize the elevator at the bottom of the loop and adjust the collective to resume level flight.

Note: A classic novice mistake is over-controlling the collective adjustments because a pilot wants to see his inputs having a noticeable effect, but instead he ends up producing an irregular loop. Understand, if done well, your collective adjustments won’t actually be seen, but be just enough to keep the loop round.

One of the neat things about heli flying is that it’s possible to perform loops at slower speeds as well: Compared to a high speed loop, a slow speed loop requires slightly more positive collective as you pull up to generate the upward movement necessary to perform the first half of the loop, and you’ll most likely need more negative pitch over the top as well. Without a lot of forward momentum, you may also have to fine tune (reduce) the elevator to maintain forward progress over the top and around the backside of the loop.

Note: Slow loops tend to require more positive collective at the start and more negative collective over the top, in addition to elevator adjustments to maintain forward progress and shape.
Stationary Flips • Backflips and Piros on top of Loops

A backflip is essentially a really tight loop with full up elevator started from a stationary hover. At the same time you start pulling elevator, briefly add positive collective to start an imperceptible climb that will prevent the heli from dropping as the body flips through vertical. The collective must be centered shortly after the nose starts pitching up to remove any thrust that would cause the heli to start moving backward. As the heli approaches inverted, pull a small amount of negative collective to prevent the heli from dropping during the inverted portion, then re-center the collective until the backflip is nearly finished. Note that since the heli is inverted for only a brief moment during the flip, the application of negative collective needs to be brief as well (“in-out”). Similarly, hold off on resuming positive collective until the backflip is almost completed, because if you rush into positive collective before the heli is near level, you’ll end up thrusting the helicopter forward before completing the flip. You can also apply these rules to forward flips with full forward elevator throughout.

Adding a backflip to the top of a loop isn’t that difficult, but it certainly makes things more interesting! This maneuver is relatively easy due to the altitude gain prior to the flip, plus the flip doesn’t have to be perfect to succeed at the maneuver as long as the loop is tracking well leading up to the flip (thus always prioritize a good loop before thinking about the flip. As the heli nears the top of the loop (inverted), simultaneously pull full elevator and significant negative collective to initiate the flip. In this case, moving forward during the flip is required to continue looping, so leave the negative collective in until it’s time to switch to positive collective as the heli approaches the upright portion of the flip, then leave in the positive collective until the heli is inverted. Finish the flip by centering the elevator and collective, and then gradually reintroduce elevator and positive collective to complete the loop.

Another cool variant consists of performing a 360 degree piro over the top of the loop. All aspects of a conventional loop apply, such as locking in the elevator throughout and applying slight negative collective during the inverted portion, but with the addition of a quick 360 piro over the top. The key to this stunt is concentrating on finishing the piro with the body straight before smoothly transitioning into positive collective on the backside of the loop, thus avoiding an awkward skid, or worse.

♦ KPTR: If the pos. or neg. collective moves the heli during a stationary flip attempt, the input was either too big, held in too long, or more likely premature.