Three Steps to 3D

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Learning Advanced Aerobatics with the Hangar 9 FuntanaS

Several folks have asked me to provide hints for pilots that are interested in trying their hand at the latest thrill-3D Aerobatics. This is a three-step progressive flying guide for your Funtana. It's designed for those who have moved up from trainers or sport planes and want to try 3D with this aircraft. The Funtana is an excellent airplane for 3D and you should find these techniques helpful for building the most complicated freestyle sequences.

Step One - Airplane Setup and Configuration

To begin, one must start with a solid flying platform before moving to the complex and exciting 3D maneuvers. I highly recommend that you utilize a radio that has dual rates (low and high). The airplane flies best on either of these two rates, but not in-between. Flying in-between these two rates, particularly on the elevator, will not be enough for effective 3D, yet will be a handful to try and fly conventionally. Using two rates (low rate and 3D rate) allows you to safely and quickly switch between the conventional rate and 3D.

Low Rate Setup
I recommend starting on low rate for Elevator control throw, as shown in Figure 1. The rate that I recommend is 5/8 inch up, and 3/4 inch down. This differential provides the same loop radius for inside and outside loops. Next is Aileron low rate setup. Note the differential in the ailerons. By having slightly more up (3/4 inch as shown in Figure 2) than down (5/8 inch as shown in Figure 3) it allows more axial rolling.

High Rate (3D) Setup
Elevator high rates setup is shown in Figure 4. Elevators are set on 3D rates at approximately 40 degrees up and down. Ailerons are set for 2 1/8 inch up and 1 7/8 inch down. Again, the differential helps during 3D.

Exponential
I suggest exponential in order to provide a softer feel around neutral. For my setup, I use 15% expo on all the surfaces on low rate to start. For 3D rates, increase the expo in proportion to the percentage of high rate. For example, 45% expo on high rate (that has about 3 times more throw) will give a similar feel as low rate around neutral, making it easier to transition to and from 3D rates. My elevator dual rates are 21% control throw on low rate with 15% expo; 100% throw on high rate with 45% expo.

Flying Trim
Low rate should be used on the first flight, plus takeoffs, landings and all conventional flying. I suggest if you have "trim rate" adjustment on your computer radio, set it to 1% for all the control surfaces. This allows the fine trim resolution for a perfect setup. After taking off, trim the Funtana "hands-off" for 3/4 throttle straight-and-level. I suggest trimming at 3/4 throttle because the plane is designed for 3D speed. Reserve full throttle to aid during aerobatic maneuvers.

Next, when you are comfortable with the straight-and-level trim, pull a few loops. With the throttle at half to 3/4 throttle, pull back all the way on the elevator and add power over the top. Cut the throttle to about 1/4 when nearing the bottom of the loop. If you feel any tendency of the plane to "roll off," reduce the low rate on the elevator some, and add a couple of clicks of rudder. For example, if the Funtana rolls off to the left as it's coming around the last part of the loop, add several "beeps" of right rudder. Figure 5 shows how much right rudder trim I put in for nice stable loops. I have about 1/16 inch of right rudder trim. Also note that the elevator should be parallel with the wing to provide smooth and precise loops. The plane should now loop conventionally with no tendency to snap, or roll off to one side.

Knife-Edge
Again, with throttle at trim-speed (3/4 throttle) roll the plane into knife-edge and hold. It helps to have someone next to you with a pad and paper. You can verbally tell your helper "needs a little up elevator with right rudder" for example, which you can enter in the computer radio after you land. I set up mine with 10 percent mix up elevator for right rudder and 10 percent mix up elevator for left rudder.

Conventional Aerobatics
Your Funtana is now set up for conventional aerobatics. The plane should fly very stable in all attitudes. It should roll and knife-edge well and generally have the same feel as a standard (but lightly wing loaded) sport plane. Fly it some to get familiar with the plane in this configuration.

3D Rate Elevator

Step Two - Learning Basic 3D Aerobatic Maneuvers

Low Rate Elevator

Now that the plane is set up, trimmed well and you are familiar with its conventional aerobatic flight characteristics-it's time for 3D. While learning basic 3D maneuvers, I recommend takeoffs and landings on low rate, while flying the 3D on high rate, at a safe altitude, until you are very familiar with the flight characteristics and recovery.

The first basic 3D maneuver I suggest that you start with is the 3D loop, or "Waterfall." Basically, with the plane flying straight and level (and a few mistakes high) switch to 3D rate, let the plane slow down, and then simultaneously increase the throttle and up elevator to complete a "3D" loop. Normally, you reduce the throttle at the top of the loop and the plane will come right around to where you started. You can try this upright and inverted. When inverted, you will find that the torque and right thrust start to work against each other during the outside loop. It's something that is very similar in all 3D planes, whether TOC-size or .40-size. More on this later…

The next maneuver is the 3D inverted spin. The Funtana, like most 3D aircraft, prefers to spin to the left. Enter the 3D spin as you do a conventional spin, but as it begins to flat spin, add power and adjust the elevator input to give you the desired spin decent rate. So, by the numbers- enter from inverted (high) stall and push the rudder right, aileron left and down elevator (about half throw). As the plane is spinning, increase elevator and throttle settings to eventually flatten out the spin until it is barely descending. To recover just ease off the throttle some, neutralize the rudder and fly out inverted. An interesting variant of the flat spin entry is through a blender. Basically entering high, upright, reduce the throttle and slow the plane down. Next push the nose straight down and put in left aileron. Finally push in the right rudder then down elevator while increasing the throttle. The resulting blender will transition into a flat spin that you can continue working with and then fly out as described above.

The final basic 3D maneuver is called the Harrier/Elevator. Basically, enter this maneuver medium altitude (several mistakes high) and slow the plane down. Pop in the up elevator and the nose will come up with the wings partially stalled- with the plane settling in a vertical decent and the nose level with the horizon (low throttle) demonstrates an Elevator. A Harrier is a variant of the Elevator- the plane begins to fly at the same altitude with the nose pointed up about 30 degrees (medium throttle). Here is the trick. The wings may begin to rock- at which time you adjust the elevator, rudder and aileron to reduce the oscillation. Wing rock is a normal occurrence and takes place when the horizontal stab partially blocks the vertical stab. You can reduce the elevator input momentarily as the wings cross level, which will damp out the wing rock. There are two other techniques to use in order to reduce the oscillation. First is through control surface trim- turn out each aileron clevis to move the ailerons "up" by about 1/8 inch. The second is to adjust the 3D elevator rate to "tune" in the best alpha angle, which reduces vertical stab turbulence. For example, one may need slightly less than full up elevator to settle in to nice harrier flight. From there you steer with the rudder, and if needed a little aileron.

Step Three- Advanced 3D Maneuvers

Finally, we are ready for the pinnacle of 3D flight. Inverted Harriers, Torque Rolls, and Rolling high alpha flight are the building blocks of all the exotic freestyle sequences. I recommend that you combine a practice regiment of flight simulator work coupled with actual flight with the Funtana to perfect these maneuvers.

Inverted harrier

Inverted Harriet/Elevators. The inverted version of the Harrier/Elevator maneuvers are very stable and that is why many freestyle pilots prefer them to upright harriers. The vertical stab is pointed down and clear of any turbulence created by the horizontal stab. Now, you'll notice that the right thrust works as left thrust when you're inverted. You may ask, "Why put right thrust in at all?" Right thrust provides very stable upright harrier flight as well as easier, more predictable torque rolls. You also have that ultra-stable feel during conventional (low rate) flight. How do you get around the right thrust- inverted issue? You have to add left rudder. This is particularly important when you add throttle during inverted harrier "cruising". Figure 6 shows what left rudder input looks like when compensating for thrust/torque during an inverted harrier.

Torque Roll. The torque roll is just a natural extension of upright and inverted harrier flight. When pulling vertically out of a positive Harrier for example, the plane will remain stationary while you increase the throttle, then begin to "torque" around to the left and begin rolling "on the prop". Like all the 3D maneuvers, I recommend starting at medium altitude until you learn how to sustain (and recover from) torque rolls. Recovery is normally no more difficult than a half Waterfall back to level upright or inverted flight. What's the secret to keeping things "balanced" in a torque roll? Picture the airplane in a conventional slow roll. As the plane starts to roll, you have to add rudder, then down elevator, then opposite rudder, then up elevator in order to keep rolling axially. The same holds true for a torque roll. If there is any wind, the airplane (with respect to the ground) will try to weather-vane into the wind and fall over. Just as one puts control inputs to keep a conventional slow-roll axial, the exact same inputs are used during a torque roll to keep the plane vertical (with respect to the ground). By the numbers- you pull up vertically and reduce power until the plane begins to torque roll. Lets take the case where you enter downwind from the left (with the wind blowing from the left). As the plane begins to rotate to the left, first put left rudder in, then as the plane rotates another 90 degrees, put in up elevator, then right rudder, an finally as it comes around 360 degrees, put in down elevator. The whole time this is occurring, the plane is drifting with the wind, with the fuselage vertical with respect to the ground. I attempted torque rolls unsuccessfully for years until I learned this technique. After

Low rate aileron down

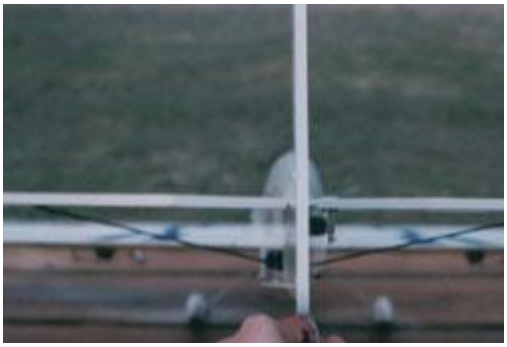
Low rate aileron up

that, the maneuver became easy.

The final step in learning advanced torque rolls is refining the inputs to a point where you can tilt the nose slightly into the wind without falling off. This takes a lot of concentration but enables you to torque roll with the plane in a stationary point, without drifting in the wind.

Rolling Harriers. This is the final 3D building block maneuver. I suggest increasing the low rate ailerons at this time by about 10% to

15%, which puts them at about 40% throw. The elevator has more than enough throw on low rate to practice this maneuver, and there is enough rudder to keep up with the plane. This maneuver is basically executed similar to a regular roll, but inputs are coordinated to keep the nose upward while rolling.



Right rudder trim

This guide should give you the basic and advanced maneuvers that can be combined, modified, and tailored to build your exotic freestyle routine. For additional references, check the Horizon website for some additional details and descriptions on 3D maneuvers.