

Training Corner

THE GYROPLANE TAKEOFF

*The first in a series of articles by:
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Half of the students I fly with are private airplane pilots, and they all have trouble with the gyro takeoff. The other half of the students have trouble also! Let's see if we can make some sense out of the takeoff by taking a closer look at what is going on.

Lift is produced by only two ways; airspeed over the airfoil, and by angle of attack of the airfoil. A blade is a rotating wing. Lift comes from the speed of rotation and also from airflow over the entire rotating wing system caused by forward speed called translational lift.

Since an airplane has its wings fixed, the airspeed is caused by the propeller moving the plane forward. We minimize drag to accelerate as quickly as possible. When rotation speed is reached, V_r , the control column is moved aft raising the nose to create angle of attack to generate additional lift, and up we go! The objective during the entire takeoff roll is to continue to accelerate to best rate of climb, V_y , as quickly as possible without gaining too much altitude. At no time do we stop picking up speed or slowing down. The purpose is to climb to a safe altitude at a safe airspeed as quickly as possible.

The same holds true of the gyro. Begin your takeoff roll continuously picking up speed, and get to V_y , or green line airspeed, as quickly as possible. Re-

member that green line airspeed is that velocity beyond the height-velocity curve, or no man's land! I'll cover this in a later article in more detail.

The above happens best at minimum drag. The minimum drag configuration occurs when the longitudinal axis of the gyro is parallel to the ground. It is the quickest acceleration from a standing start for both a gyroplane and an airplane.

Now for a major difference. In a gyro, we need to gain rotor speed for additional lift. Remember, the rotor wing chord is very small and needs to get to hundreds of miles per hour airflow over the wing to produce sufficient lift. It is similar to a cruise missile wing where a rocket motor accelerates the aircraft up to a sufficient speed for the small wings to carry the load. In our gyro we get the wings up to the hundreds of miles per hour but in a circle. Here is how that is done.

The propeller thrust in a gyro has one more task than in an airplane. Airplane propellers only translate. Gyro propellers must also translate, but in addition, rotate the wing. Consequently, as a gyro begins a takeoff roll, we must accept an increase in drag by aft stick letting maximum airflow into the bottom of the rotor system. As the nose comes up we still must hold the nose off bal-

ancing on the main gear letting the rotor speed continue to build until it can carry our weight. By keeping the nose in the sweet spot, the gyro will continue to pick up both rotor speed and translational speed. When sufficient energy is available, it will fly!

The nose high attitude at liftoff is analogous to an airplane short field takeoff at best-angle-of-climb, V_x . When the obstacle is cleared, you lower the nose and accelerate to V_y , best-rate-of-climb. If you don't lower the nose, you climb out with increased drag, and it takes longer to get up to altitude. Once above the obstacle, there is no useful purpose flying that configuration.

What about the gyro! The takeoff is analogous to a soft field airplane takeoff. The airplane soft field takeoff starts with full aft elevator getting the nose off the ground as quickly as possible. The next task is to unload the main gear, e.g., start lifting them out of the mud. As airspeed is gained and lift is generated, you keep the nose down low getting the plane off the runway in ground effect. As soon as you are in the air, keep the plane level and accelerate out of ground effect to V_y before trying to climb. This can consume a fair amount of runway. You have just made a proper full energy gyroplane takeoff!

Most airplane pilots I fly with, both

private and commercial, can not make a proper soft field takeoff. They get the nose up, hold that attitude, and let the airplane fly itself off. Wrong! If you do that you will climb out at a steep angle, but will climb with a slower airspeed and slower rate-of-climb.

You must relax stick pressure as you pick up speed to keep the nose just off the ground in the sweet spot until the main gear comes off. When firmly in the air, lower the nose more to level the keel picking up speed before trying to climb. Accelerate to Vy as quickly as possible before climbing out.

CAUTION: This all may sound easy, but it is not. Do not experiment on your own.

In my next article, THE TRICKY FLIGHT CONTROLS, I will tell you why the coordination of gyro flight controls is a bit tricky. A lot is going on and

you have to be quick and accurate. Many of the mishaps and damage I hear about occur during ground operations.

Remember, "the air, even more so than the sea, is most unforgiving for the slightest mistake." Get qualified flight instruction before getting into a gyro. Skillful pilots make it look easy, but it is not.

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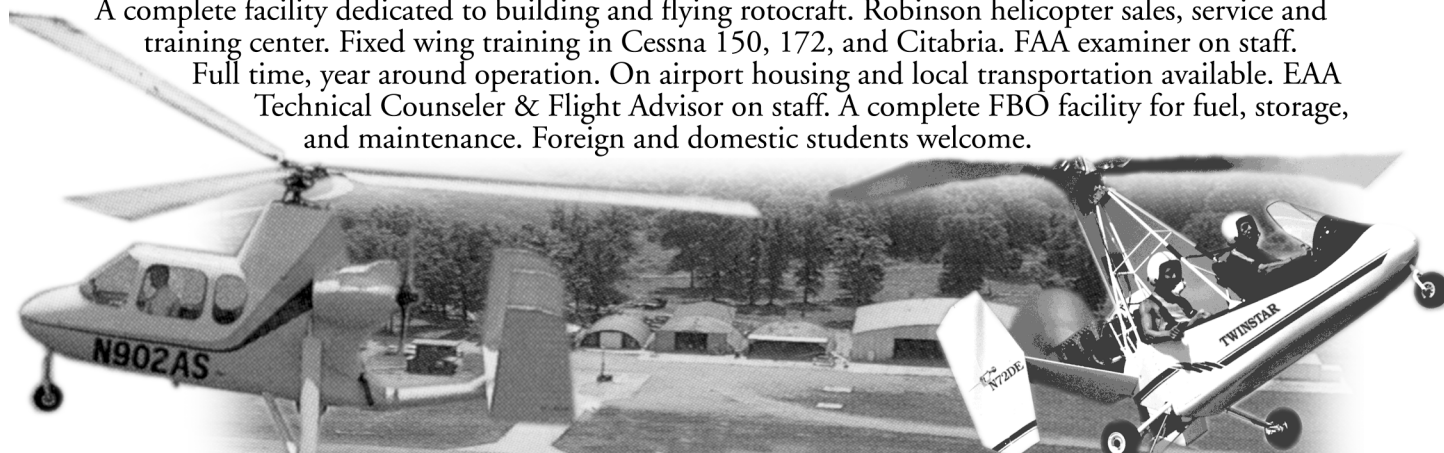


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