

# *Training Corner*

## **The Management of Rotational and Translational Momentum**

*The fourth in a series of articles by:  
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The gyroplane is the safest machine to ever leave the ground. This only holds true if you operate inside the operating limitations of the aircraft. The point of training is to learn and recognize these limitations. Most noteworthy is the height vs. velocity curve, commonly known as the dead man's curve. Likewise important is proper blade loading.

The height-velocity curve deserves understanding and respect. It determines if you have enough energy to make a soft landing in the event of a power failure. "Remember that all engines quit...just some more often than others." Knowing your height-velocity curve and staying out of it can mean the difference between being carried away from your landing or walking away from it.

Let's start by making a vertical descent with the engine at an idle. The rotor blade continues to turn driven by the horizontal component of lift. Vertical speed varies, but it approximates being dropped to the ground from a height of six to eight feet. That is hard enough to cause equipment damage and possible injury. Obviously you need to create more lift at touch down.

Remember that the only two ways to produce lift is an increase in airspeed over the airfoil, or to increase the angle of attack of the airfoil. In a vertical descent you have no airspeed. The rotor blade is at a fixed pitch, and thus you can not increase angle of attack. If you can gain

additional airspeed, however, it can be converted to more lift. Here is how it works.

As the blades spin and are at each side, they are for a moment a narrow cord fixed wing. Gaining more forward airflow produces more lift. In fact the entire rotor dish begins to act like a solid wing as it moves forward. All rotor systems do this, and it is called translational lift. When you enter into translational lift at about 35-40 mph you climb faster and can hold altitude with less power.

An airspeed of 40 mph is usually a good approach speed. By applying aft cyclic, you can pitch the nose up and enter into the common landing flare. Angle-of-attack of the entire rotor dish increases producing enough lift to cancel all vertical descent. The by-product of producing lift is drag, which slows you to a halt. A feather soft landing with minimum ground roll is what a gyro landing is all about.

The minimum safe airspeed is 40 mph. It takes that much forward speed to produce a soft landing. What about flying slower than 40 mph? You can do it safely if you have enough altitude to gain 40 mph at touch down. A drop of 100 feet will yield 20 mph. This means that 200 feet is necessary to gain 40 mph, if you have no airspeed. You can be in a vertical descent; at 200 feet lower the nose and you will accelerate to 40 mph at touch down.

Here is a height-velocity curve  
RULE OF THUMB: above 200 feet, 0 mph; 200-100 feet, 20 mph; 100-surface, 40 mph.

Gross weight and density altitude will modify this rule. You must determine your own. Use a 200-foot soft deck to check yours. The height-velocity curve is that combination of speed and altitude that will allow you to land at 40 mph.

Likewise, and for the same reason, your climb-out after take-off should be at 40 mph. As soon as you are 3 feet above the centerline, level your gyro and accelerate to 40 mph,  $V_y$ , and best rate of climb. You will, also, have attained translational lift and you'll go up like a homesick angel. If you climb out at a steeper angle and slower airspeed and your engine quits, you are in dead man's curve. Only heaven can help you.

Now for a short comment on blade loading... Blade speed is determined by the weight that the blades have to carry. It is imperative that you keep the weight of the gyroplane on the rotor blades. For now it is sufficient to say that by keeping the keel close to level and climbing and descending at 40-50 mph the blades will stay properly loaded.

CAUTION: This all may sound easy, but it is not. Do not experiment on your own until you have mastered energy management.

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# Redbird here...

Congratulations to our photo contest winners Jeff Christie (see front cover), Wade Knowlton (see back cover) and Dick Bosworth (see page 4). Jeff will receive the first-place prize of an EIS system from Grand Rapids Technologies, valued at \$500.00. Wade becomes the proud owner of our second-place prize from Comtronics Engineering, an Ultra-Pro Helmet, valued at \$289.00. And Dick will be dressing in style with a PRA jacket for his third-place photo. We can't thank our contest sponsors enough for their generous prizes. Please, do me a favor and patronize our sponsors.

Our panel of judges had a tough task sifting through nearly 100 photos. Our chief judge, Bill Naeger, a professional photographer in Southeast Missouri and author of a newly-released book *Ste. Genevieve, a Leisurely Stroll Through History*, was looking for more than just a snapshot. His emphasis was on creativity, use of light, mood-setting, etc. I believe our judges picked three ideal photos.

Thank you all so much for taking the time to enter our contest. As far as I'm concerned, you're all winners!

You don't need expensive camera equipment or much photography expertise to wind up with a good photo. For the most part, it just takes a lot of film. Try to look at settings in a different way. Wade saw the dramatic clouds as the focal point of his photo; Dick saw the fog as an unusual backdrop; and Jeff, of course, used his imagination 110%. Experiment. Have fun with the camera.

You'll find more of our contest entries and other great submitted photos in our pullout 2000 calendar section. We had hoped to use color again on our calendar, like we did last year. However, as a cost-cutting move, we decided against it. Given the low rating the calendar issue received on our recent web survey, we really couldn't justify the cost. But a great photo is still great in black and white. I believe the terrific photos in the calendar will carry you through the year 2000 rather nicely and look pretty nifty on your office or kitchen wall!

We'll feature even more of our contest entries on front and back covers to come.

Now don't stop submitting photos and stories. Our PRA members can't get enough of them. *Keep them coming!*

# Redbird clear...

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In my next article, MORE ON ROTATIONAL MOMENTUM & BLADE RPM, I will tell you some things that will change blade speed. If understood and used properly, it will enhance your flying. If not understood, it could be your last flight.

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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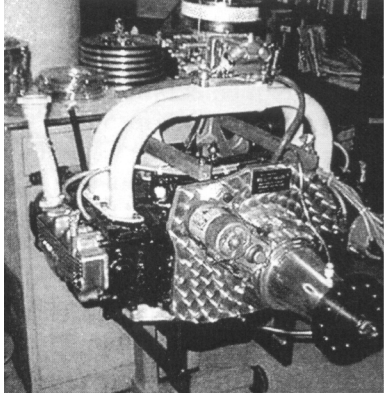
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