Training Corner

More on Rotational Momentum and Blade RPM

The fifth in a series of articles by:
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In my last article, THE MANAGEMENT OF ROTATIONAL & TRANSLATIONAL MOMENTUM, most of my article dealt with translational momentum, or energy. The central theme was the height-velocity curve which is the combination of airspeed and altitude that will permit you to attain 40 mph for landing. Touching down slower than 40 mph means you risk not having enough energy to make the landing flare, which increases your lift and decreases your airspeed.

However, maintaining 40 mph can be a tricky task. The reason is that drag can reduce your airspeed so fast that you won't want to believe it really happened! Let's look at two profiles that can get you into trouble very quickly.

We will start with the take-off. The propeller is driving you forward building total available energy. You level off above the center line and accelerate to Vy before climbing out. In an abrupt power failure you will tend to swing forward and the nose will pendulum up. When your nose is up with no power the drag is up and airspeed disappears so fast you won't believe it. You could find yourself swung up to 15-20 feet with no airspeed. About all you can do at this point is to hang on and prepare to crash. You are into the dead man's curve!

The reason you swing up is because when the push suddenly stops, the rotor has more drag than the fuselage. The rotor disk stops on a dime and you keep swinging forward and then up converting what airspeed you had to additional altitude.

Knowing this is going to happen, and then as it happens, you apply forward pressure on the stick holding the nose level. Notice I did not say push the stick forward. You must, however, use deliberate forward pressure to avoid the swing-up.

Finally, there is one more place that can get you into even worse trouble. Due to this forward swing-up when the push ends abruptly, if you make a climbing turn below the top of your height-velocity curve, you are in double trouble. A turn is a very power intensive maneuver. Add to this a climb with the nose already somewhat up, and you have just compounded the problem. Being at 100 feet with no airspeed is an experience you just do not want to have.

Here is a ***RULE OF THUMB***: never make climbing turns below the top of your height-velocity curve. Either climb or turn, but never-ever do both together.

If you get slow with an engine out, a new complication enters the situation. It is that of rudder authority. In a vertical sink with no engine, the gyro will spin in the direction of the rotating blades. You must counter with opposite rudder. When there is insufficient airflow past the rudder, it can not stop your rotation. You may end up impacting sideways to your direction of travel. You might find some comfort in knowing that when you flare a gyroscopic moment would swing the nose to the right. It may or may not be enough. With a dead engine your landing approach speed should be increased to 50 mph.

Many different kinds of rudders are in use with a variety of surface areas. While area affects authority, so does the length of the moment-arm from the center of rotation. This means that a small rudder at the end of a long lever-arm can be more effective than a large rudder on a short arm. Designs differ and you must know you machine.

Now comes the fun part. I'm sure by now you have the idea that you always have to land at 40 mph. Not true! You always have to have enough lift for a soft landing, but it does not have to come from translational or forward airspeed. It can come from additional rotor speed. Several conditions will produce addition blade speed.

We sometimes refer to over-spinning the rotor when the rotor speed increases to an rpm greater than that required to fly straight-and-level. It occurs in a level turn which is why you must reduce power coming out of that turn to reduce the over-spin to avoid gaining altitude.

Another place it occurs is in a tight, or decreasing radius turn. Banking into a turn and then pulling back on the stick makes the blades feel more weight, and they respond by spinning faster to carry the addition weight. You will lose airspeed fast by doing this. If you time a landing correctly, you can roll level at your touch down point. The airspeed and descent are minimal, and it will look like

a helicopter in a hovering landing. Never do tight turns inside the height-velocity curve. When you start hauling back on the stick you need to be about one-half a rotor diameter from the ground.

CAUTION: This all may sound easy, but it is not. Do not experiment on your own until you are a master at energy management. Work into it slowly one step at a time.

In my next article, UNLOADING THE ROTOR & THE POWER PUSH-OVER, I will tell you a condition that will decrease rotor speed. This one kills!

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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Captain Miller receives GBA Pioneer Award

Groen Brothers Aviation, Inc. (manufacturer of the Hawk 4 Gyroplane) has awarded Capt. John Miller their annual "Pioneers of Vertical Flight" award. The presentation was made at this year's Aircraft Owners and Pilots Association's (AOPA) Expo '99 in Atlantic City, NJ. on Oct. 21, 1999. The award ceremony featured film footage from the 1930's of Capt. Miller piloting autogiros from the roof of the Philadelphia Post Office and scenes from the American Air Aces Show of Miller looping his Pitcairn PCA-2 autogiro.

GBA created the award to acknowledge and celebrate the dedication and contributions of those early aviators and designers whose adventuresome spirit led to the successful advancement of vertical flight. Details at: http://www.gbagyros.com/news/crnt_news.htm

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