

A LITTLE CATCH-UP: In my discussion of takeoff procedure in the last *RVator*, I neglected to mention the use of flaps. To use or not to use? Personally, I always use about 20 degrees, ($\frac{1}{2}$ flap) for takeoff. Why? Perhaps it is a carry over from my earlier days of flying from extremely short runways where minimum length takeoff roll was more critical. Now, since most of the runways we use are 10 times the length of our minimum takeoff roll, this would seem a moot point. However, in addition to lowering the stall speed and thus shortening the takeoff, use of flaps also decreased the angle of attack needed for flying at any given airspeed. Lifting off at 60 mph with flaps will be at a slightly lower angle and thus better over the nose visibility than without flaps.

One negative of using flaps for takeoff is that the need to retract them adds one more task during the early climb out phase; two, if you count the additional trim adjustment that's usually necessary as a result.

Overall, I can't get real excited about advocating a preferred flap position for takeoff. I feel more comfortable when using them, but can't offer any overwhelming proof of benefits. My best suggestion is to experiment, first under ideal flight conditions, performing takeoffs both with and without flaps to determine which method offers you the maximum comfort level. Other factors can affect your flap use decision. On a shorter, rougher field you may want to use flaps to lift off as soon as possible, whereas on a smooth paved runway, you may want to ignore them. In the final analysis, maybe "one size" does not fit all (circumstances). Through flight familiarization, the pilot should determine the precise benefits and burdens of flap use under varying conditions, and thus be better able to choose when to use them to advantage.

POST-TAKEOFF CONSIDERATIONS: The wheels have left the ground. Hallelujah! You have just accomplished a re-enactment of the Wright Brothers triumphant struggle to overcome the limitations imposed by our universe on previously flightless man. You are free to navigate the boundless oceans of air, to soar with eagles, gambol among the grand canyons in the clouds, etc., ad nauseum. Or are you? With a powerful and reliable engine capable of pulling your RV upward at a healthy climb gradient and the perils of the ground behind you, you'd think your worries were over. Experience sayeth otherwise. Many accidents, some fatal, have happened to RVs in the early post lift off portion of flight. Let's explore some of the things that can go wrong and how to avoid them.

PRE-MATURE LIFT OFF: We touched on this subject last time; primarily in conjunction with a crosswind takeoff. However, it can be a problem under even calm wind conditions, particularly at high density altitudes. Technically, the problem with a premature lift off is that you are flying "behind the power curve". While this phrase has come to mean the same as being "behind the eight ball", in legitimate aerodynamic terms it means that you are flying in the area of reverse command. This means that while you are flying at a minimum airspeed, your drag is very high and acceleration will be difficult unless you can lose a bit of altitude, or at least fly level in ground effect until you gain enough speed to lower drag and establish a positive climb rate.

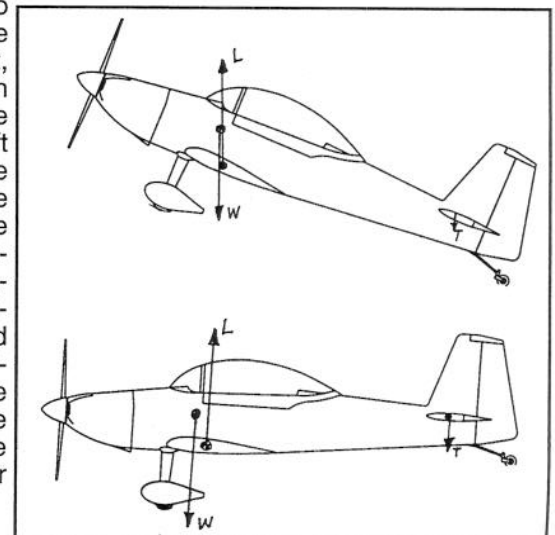
Your best bet is to lower the nose in hopes that the

airplane will begin to accelerate. If not, maybe you can gracefully get the wheels back on the runway and either brake to a stop or gain enough speed to lift off with a better stall speed margin. Failing this, it is very probable that you will have difficulty maintaining directional control and will veer off to the left (P-factor) and hit something. Worse, you may attempt to gain altitude by stick back pressure. The airspeed drops further and you stall, drop a wing, ground loop, flip over, or perform other similar unpleasant maneuvers.

FAILURE TO APPLY P-FACTOR CORRECTION: Most RVs require fairly heavy rudder pedal pressure to compensate for Torque or P-factor loads. A common alternative is to use the very effective and light ailerons to compensate for P-factor. This works, but caused the airplane to fly un-coordinated; in what is best described as a forward skid. Generally, the only downside of this flight condition is, well, your backside--- the seat-of-your-pants should be sensing side pressure indicating the skid the aircraft is experiencing. Should you permit speed to decay and the aircraft to stall while flying in this un-coordinated condition, you will experience a pronounced wing drop and perhaps even a spin entry. This is not considered good form ---nor does it aid the eventual collection of retirement benefits.

FAILURE TO RECOGNIZE WEAK PITCH PHUGIOD IN HIGH POWER CLIMB MODE: You remember your old friend the Phugoid: the rate (in pitch cycles) at which an aircraft will return to trim speed following a speed disruption. Well, in a low speed, high power climb condition, the phugoid is weak, meaning that it has an impaired or diminished tendency to return to a stick free trim speed. To the pilot, it means that a light stick force input will cause a proportionally greater speed change than it would in cruise flight. The danger here is making a speed reduction which could lead to an unintentional stall.

Two factors combine to cause the weak phugoid. One is the high power setting which, in any condition, causes a pitch-up attitude. The other is what I will refer to as the "pendulum effect" of the aircraft center of gravity and center of lift. In the illustration we see an aircraft in level flight vs. the same aircraft in a steep climb attitude. The C.G. is positioned forward of the C.L., and is balanced by an aerodynamic down load caused by the angle of incidence of the horizontal stabilizer. I have exaggerated this illustration to demonstrate the effect, which is that, in a climb, the C.G. moves aft relative to the C.L., because of the fuselage angle and reduces the stabilizing moment designed into the aircraft. Notice the size of the T (trim) force arrow under



the stabilizer. With only a light stick force needed, it's easy to see that speed control is very important in climb.

Whether or not this is a precise explanation of cause, or whether you fully understand it, the fact remains that in a high power climb condition the pilot must exercise more attention to speed control than in normal cruise flight. The pitch control sensitivity and the relatively narrow speed margin above stall speed make this a potentially dangerous place to be.

PRE-OCCUPATION/ DISTRACTION: During post-lift off departure, the pilot's work load is high, and distraction caused by a number of factors can lead to loss of speed control. Some of these are:

- ◆ Engine monitoring and engine control manipulation
- ◆ Radio communication
- ◆ Navigation-setting GPS, checking compass headings.
- ◆ Traffic, planes and birds.
- ◆ Loose objects moving about the cockpit.

In a relatively high performance plane such as an RV, things happen faster than in low powered trainer and touring airplanes. You lift off sooner, move forward faster, reach pattern altitude sooner, etc. There is less time to perform the essential flight tasks.

What if your sunglasses or a folded map slides off the dash, do you immediately look down and retrieve them? Well, don't! They will be just fine lying there on the floor until you have nothing better to do than to retrieve them. Right now, you need to pay attention to your flying.

Our primary advice is the old axiom; *fly the airplane first*. Most of the other complicating factors can wait. It is more important to maintain control over the aircraft than it is to adjust prop RPM, respond to the tower controller, or set your first waypoint into your GPS. Keep your priorities in order.

HOT DOG: "Let me show you how this baby climbs". A phrase that scares me every time. Because the RVs are attractive sport planes and because they offer impressive climb rates and angles, some pilots (including myself, I must confess) sometimes like to show off this performance to airport bystanders. To show the maximum climb angle, the pilot tends to climb at a lower than optimum speed. Now, throw in what we have just learned about weak pitch phugoid, and add a new distraction factor, say, looking down to see if the bystanders are indeed looking up with their mouths agape. Chances are that you aren't paying real close attention to P-factor control at this point. If these factors combine to cause you to stall and spin in, you will have succeeded in providing the bystanders something truly memorable to tell their children about.

"Have a plan—Fly the plan". The spectators will be sufficiently impressed by a safe, routine climb at best rate of climb speed.

"SUPER HOT DOG": The super-hot pilot will lift off and then maintain level flight a few feet above the runway while accelerating at full power down the runway. Then, upon reaching the runway center or runway end, whichever is deemed to be the most spectacular from the spectator's viewpoint, the pilot pulls sharply up into the steepest climb he can—the zoom. You don't have to be a genius to see where this can lead. All of the above negative factors will apply, but they will be intensified. There is one more bad thing which is likely. As your speed rapidly decays and you

need to reduce your excessive climb angle, you can easily push forward (attempt to lower the nose) so aggressively that your carbureted engine will stop, further increasing your chance for a severe stall and possible spin entry.

WIND GRADIENT: Usually, when taking off into the prevailing wind, you will experience a favorable wind gradient. The wind speed (headwind) will increase and cause your airspeed (or climb rate) to momentarily increase.

However, there are times that you will experience a negative wind gradient where the wind speed will decrease with a gain in altitude. I experience this often because my hangar and taxiway are sheltered by trees, so at ground level there is little wind. Often, upon take-off and rising to no more than 50 ft. a noticeable tail wind occurs. The result is a temporarily diminished rate of climb, and a noticeably increased ground speed relative to indicated air speed and control feel sensations. Flying this near the ground, the pilot relies heavily on visual cues, which tell him that he is flying faster than best climb speed, that he is not climbing at the expected angle, and that he should pull the nose up. Doing so could cause a stall.

Sometimes it is necessary to takeoff down wind, perhaps because of obstacles on the wind favored end of the runway. One airport I regularly use has a political obstacle which often means downwind take-offs. The runway is about 2300 ft. long, plenty for RVs and most light general aviation planes. However, when departing with a moderately strong tail wind, climb acceleration is slowed because of the unfavorable wind gradient, the climb angle is shallower because of the higher ground speed, and the pilot's comfort factor is greatly reduced because of the high visual ground speed cues and the shallow climb angle. There is a strong temptation to pull the nose up. Beware of false signals!

POWER FAILURE: Other than the flight attitude induced power failure mentioned above, there is always a chance of a mechanical power failure following takeoff. To best deal with this circumstance, you can see how important it is to be flying according to a plan and to be able to concentrate fully on keeping the airplane under control and then dealing with this new problem. Emergency landings and engine problem management are topics which will be covered in detail at another time.

ACCIDENTAL CANOPY OPENING: If your canopy was not properly closed and locked, it will most likely pop open soon after lift off, as speed starts to build. Depending on the model RV and the canopy latch configuration this can result in anything from a minor distraction to a life-threatening emergency. Regardless, your first impulse must be; "fly the airplane—don't stall". As with the power failure example above, this topic is worthy of a separate detailed article, and is mentioned here because it is another complicating factor which could pop up (pun intended) during take-off or climb out.

SUMMARY: So, you see, there are plenty of things that can go wrong within the first minute of your flight.

Relaxation can wait until you have reached cruise altitude and have managed the systems well in advance of your immediate needs. Then you may relax a little, enjoy the scenery, listen to your favorite CD, monitor your systems, and keep a vigil for air traffic.