A TURN FOR THE BETTER

ANOTHER IN A SERIES OF FLIGHT TRAINING ARTICLES

Ken

I'm no instructor, but I have logged over 500 demonstration flights in RVs. The experience has given me a good chance to watch what happens the first time an "RV newbie" gets to fly. A few pilots have been bang on, totally in control from the first moment. That's impressive. A few have seemed completely disconnected from the airplane (the most memorable being one fellow who kept climbing, no matter what I demonstrated. When I pointed out the solid overcast, now only about 200 feet above us and approaching rapidly, he slammed the stick forward so hard we both smacked our heads into the canopy.) That's depressive. Either way, all of us who give instruction or demonstration flights have learned that they can predict one thing with relative certainty:

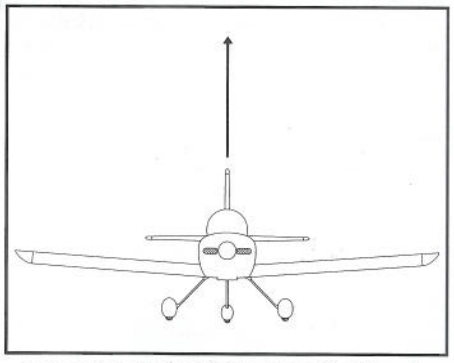
The vast majority of new RV pilots will gain or loose altitude, sometimes lots of altitude, in their first few turns. In fact, Mike Seager swears he's had students who have gained or lost 1000' in a simple 360° turn.

Now, surely, these pilots were once capable of holding such a simple maneuver to much closer tolerances in production airplanes. The standards for the private pilot checkride insist on +/- 100' on a 360° turn.

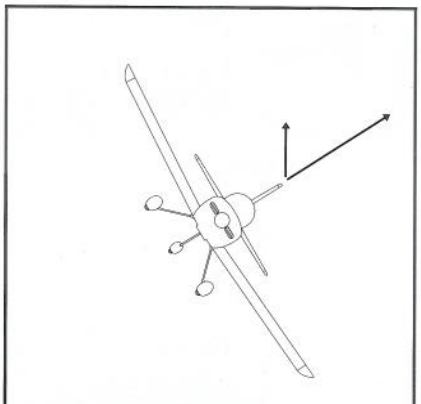
Maybe the first question to answer is "why do airplanes loose altitude in turns, anyway?" The airplane doesn't weigh any more when it's turning than when it's flying straight and level. Does turning disturb the local gravitational constant?

The answer, as your flight instructor probably taught you and you promptly forgot in that miserable buzzing, tilting box of a trainer, is the "lift vector." In level flight, the vector, or direction of force, is perpendicular to the wing or straight up. When the wing is producing exactly as much lift as the airplane weighs, the airplane remains at a constant altitude.

Now bank the airplane. The lift vector remains perpendicular to the wing, but the whole vector, the direction of the lifting force, is now at an angle to gravity. Think of it separating the lift vector into two components. The sum of the components is still the same amount of total lift, but now part of the lift is making the airplane change direction, pulling it around a circle. The rest of it is still pulling the airplane up. The force of gravity remains the same, straight down, but the force counteracting it (the straight-up part of the lift vector) has been reduced, so the airplane *must* descend. The steeper the bank, the more lift the wing must produce to maintain level flight, because more of the lift vector is going into making the airplane change direction.



In unccelerated level flight, the entire lift vector is directed straight up and counteracts gravity.



In turning flight, part of the lift drags the airplane around the turn. Only what's left over counteracts gravity, so the airplane descends..

The only way to keep the airplane at a constant altitude while it is turning is to increase the straight-up portion of the lift vector until it again balances gravity. We usually do this by pulling back on the stick, thereby increasing the angle of attack, thereby increasing the lift the wing is producing, including the straight-up portion, until it equals gravity. Bingo, a level turn. Of course, when you're flying, you don't bother thinking about lift vectors and resultant forces, etc. (Especially if you're an English Major....) You just add back pressure until the airplane stays level.

Now, anybody can do that in a trainer. Why is it so tough in an RV?

Well, it isn't. But it is just different, for several reasons.

- RVs are faster than the usual production trainer. If you raise or lower the nose of an RV by 5°, it will climb or descend farther in a unit of time by virtue of its greater forward speed.
- The RV has excellent climb performance thanks to a much better wing/power loading relationship than production aircraft. It will start climbing faster and keep climbing longer whenever the attitude is not perfect.
- Control forces are much lighter than the typical light plane. If a pilot is used to an airplane that requires 5 pounds of back pressure to hold altitude in a turn, he will find himself climbing rapidly until he learns that an RV needs only 1 pound.

All these factors mean that smaller deviations result in quicker, larger diversions. You can be farther off track faster than in other airplanes.

Now, when you come to fly with Mike or Jerry on the RV Transition Training Program, you don't want to spend that precious time re-learning basic turns. But believe me, they will insist on it, and rightly so. If a student is losing lots of altitude in turns, how can an instructor let him fly a landing pattern flying within 1000' feet of the ground? You can't afford to lose much there!

So how can you improve your ability to fly accurate turns before you fly the RV?

We believe the best thing to do is build a picture in your head of what a level turn looks like, something that can be done in any airplane. That means 'looks like out the windshield', not on the instrument panel. Jerry suggests putting a small dot on the windshield, exactly on the horizon, when you know you are in steady level flight. Exactly where this dot actually falls depends on how thick your cushions are, how tall you are, etc. Roll the airplane into a shallow bank, 20-25°. Put the dot on the horizon and cross-check with the altimeter and/or VSI. Make *small* corrections with the elevator to keep it there (steeper bank angles will require more elevator as more of the lift vector is diverted from vertical.) Remember, the instruments are there to check, not to chase. By keeping the dot on the horizon, you should be able to complete a 360° turn within a few feet of your entry altitude. (When you've really got the airplane figured out, you can forgo the dot and judge the space between the spinner and the horizon. In a side-by-side airplane, the picture will be different in left and right turns.)

If you think this dot is cheating, look at the wingtip of any competition aerobatic airplane. That array of wires is there to help the (very accomplished) pilot align the wingtip at a given angle to the horizon. These people know what works.

As an experiment, try adding power as you enter the turn. This will help maintain airspeed, and lower the elevator requirement. The increased lift provided by extra power/elevator combination will do the same thing as the increased lift provided by the elevator alone and the airplane will maintain altitude.

Experiment and practice in whatever airplane you can until you can turn at different bank angle and airspeeds and hold altitude...really hold it, not just get close. You'll find it sharpens up your pattern flying...and it will give more time on your RV checkout for the fun stuff.