

Prop Strike Prevention

By Lou Rossi

I have a friend who owns an L-19 Bird Dog (a tail-wheel airplane similar to a Cessna 180) and when I told him that we had a prop strike in our 182, his reply was “How is that possible? Isn’t there a nose wheel in the front?” I think most taildragger pilots are keenly aware that nothing lies between the propeller and the pavement (or the dirt,) and therefore maintain a much greater awareness of the pitch attitude of the airplane—especially when it is close to the ground. For example: if you are too aggressive on the elevator during takeoff or the brakes on landing, the airplane will pitch down and there is nothing that prevents the nose (and the prop) from touching terra firma—as in this video:

<https://youtube.com/watch?feature=youtu.be&t=91&v=YuE2cW8NMx8>

Indeed, the question remains: How did we strike a prop on a tricycle gear airplane? More importantly, though: What can we do to prevent it from happening again? With the insurability of the Hill Flying Club in question, I hope all of the owners will find this information useful as we strive to avoid a recurrence. In this article, I will review some common causes of prop strikes, as well as some prevention strategies and techniques.

How did it happen?

In section 1 of the POH for N5198N says the propeller ground clearance is 10 7/8” (that assumes the nose strut and tires are properly inflated.) If you look at any tricycle gear airplane not in motion, it appears almost impossible for the prop to hit the ground. However, not only is it possible, but it occurs with alarming frequency. Assuming a completely compressed nose strut and flat tire (as would be the case during a hard enough landing) the pitch down angle required to strike the prop is only about 10-11 degrees. So it is possible. (See some of the videos at the end of the article for further proof.)

“Eagle, Houston, you are go for landing, over.”

The first step in a safe landing starts way back during the approach phase. You may have heard that the key to a good landing is a stable approach—that is indeed one of the golden truths in aviation! Put another way, an unstable approach is a recipe for a bad outcome.

In the airline world (*and* the corporate world, *and* the military world, *and* the moon-landing world,) there is a **requirement** to go around if an approach doesn’t meet very specific stabilized approach criteria: fully configured, on glide path by 1000 feet AGL and additionally on speed and engines spooled up (not idle) by 500 feet. A good technique for us general aviation pilots is to similarly set stabilized approach criteria, but ones that would be more applicable to light, single-engine aircraft. For example you could use as your criteria: on speed (+5 /-0 knots) (as in stable—not chasing with pitch,) in the desired configuration, and properly trimmed no later than crossing the fence. If your approach fails to meet any of your criteria by a designated point (the fence) or if you just don’t like the way an approach looks, go around—the earlier the

better—but as soon as you recognize that the approach is unstable. Since you don't have Houston monitoring your approach, you might even add a verbal callout to each approach like "crossing the fence—stable—Landing." If, on the other hand, you are not fully configured, or your airspeed and trim are not as desired as you cross the fence your call might sound like this: "crossing the fence — unstable — go around" followed by the go-around maneuver. So, set your criteria, and stick to them! If your approach is not stable—go around! This alone would avoid most situations leading to a prop strike.

There are times, however, that you will go beyond that point and get close to the runway in an undesired aircraft state—either too slow, too fast, out of trim, not configured, or with a nose-low attitude. Even in the flare, it's not too late to go around. Just add full power (don't forget the carb heat!), set a slightly nose up attitude, and take it around the patch for another try with an undamaged prop. Even the Eagle had the option to abort the landing all the way up to the point they touched down on the moon.

It ain't over 'till it's over!

OK, now let's suppose we continue through the flare and have landed. A good landing in a tricycle gear airplane is one in which the main wheels touch down first, followed by the nose gear. In fact, every landing checklist in the Cessna POH says either: 'Touchdown--MAIN WHEELS FIRST' or 'Touchdown--SLIGHTLY TAIL LOW.' With any landing one important key is: Never stop flying once you are on the ground. What I mean by that is don't release the back pressure on the yoke just because the main wheels are on the ground. You must still gently fly the nose wheel onto the ground (or even hold it off until the elevator stalls and the nose comes down on its own.) This is best achieved by gradually releasing back pressure on the yoke as opposed to just letting it go all at once. This kind of finesse takes some practice. But, it is very satisfying to grease on the mains and the nose wheel! The key takeaway here is that you should never, ever have a tendency to push down on the yoke during landing. You are either holding back pressure, or gently/gradually releasing it.

Take THAT, asphalt!

Hard landings are another situation that could lead to a prop strike. Hard landings are usually the result of the aircraft being 1) in a low energy state and 2) too high above the ground. Sometimes, even if you have met the stable approach criteria, you may flare too high or too abruptly (ballooning) and end up stalling the airplane well above the runway. The result is the airplane literally drops out of the sky, with the weight vector pointing straight down towards the center of the earth, and the sheer momentum from the downward force of the weight of the engine compresses the nose strut and allows the prop to hit the pavement. Of course, if you recognize that you are stalling too high above the runway, the best option is to add full power, set that climb pitch attitude and go around. However, If you have a hard landing, you must still maintain back pressure on the yoke to keep the nose wheel off the ground as long as possible. Remember: the elevator is likely still effective even if the wings are stalled—especially with some prop wash going over it (remember soft-field technique? A little throttle goes a long way!) Although your ego may have just taken a very tough blow, this is not the time for your biceps or

your brain to just give up. Keep flying!! Oh, and did I mention, don't push down on the yoke during landing, ever?!

Don't have a bad attitude!

Improper pitch attitudes during landing are another common cause of prop strikes. Make sure you know what the correct attitude looks like for a good landing, and correct any improper attitudes before you get close enough to the ground to do damage. Many students have difficulty transitioning to a nose-high attitude in the flare, (or just don't flare at all) simply because they lose sight of the end of the runway under the nose of the airplane. Losing sight out front tends to be unnerving at first, so the natural tendency is to pitch down to regain a visual perspective out of the front of the windscreen. This leads to either a flat, or worse, a nose-down landing attitude. Eventually, you will develop the skill to use your peripheral vision to compensate for this. There should be two distinct touchdowns on each landing (three in a crosswind.) If you don't land with the main wheels first, and then the nose wheel second, you're doing it wrong. A landing on all three wheels in a tricycle gear airplane indicates a flat landing and is simply bad technique.

Bouncing is for balls!

A bounced landing is the one most likely to result in a prop strike. Usually it happens when an airplane has too much energy (airspeed) coming into ground effect. If you carry too much airspeed and touchdown, the aircraft has a tendency to bounce back into the air. After the aircraft bounces, the pilot wants the airplane to get back on the ground, so the natural (albeit wrong) tendency is for the pilot to lower the pitch (again, you should never push down!) This leads to a second touchdown which is nose low, and at a higher descent rate than desired which sometimes leads to another bounce, and another overcorrection by the pilot, and so on. This is called porpoising (picture the way a porpoise swims along the surface, jumping out and diving back into the water repeatedly.) It is also known as a PIO (Pilot Induced Oscillation,) or Phugoid.

The best way to avoid a bounced landing is to maintain the proper airspeed (properly trimmed) on final. Think of it this way: it is better to stall the airplane a few inches above the ground with a proper nose high attitude and drop it onto the mains (full stall landing) than it is to come in too fast, bounce and porpoise.

If you bounce a landing, the best option is to go around (hmmm, is there an echo in here?). If you bounce, preferably while still airborne, immediately add full power (your hand is already on the throttle, right?), set a nose-up pitch attitude (like a normal takeoff rotation attitude) and patiently wait. You might even settle back to the ground again under some circumstances, but if your pitch is correct, it will be on the main wheels, so just continue with the go around as if it were a takeoff. The bottom line here is: Do not try to save a landing from a bounce! Just take it around the pattern and try again. This is what can happen when attempting to land from a bounce:

<https://youtube.com/watch?v=G9FkYpvTyrc>

So, to recap:

- Always start with a stable approach. Set your criteria (for flaps, airspeed, trim and power) and stick to them, and if any approach doesn't meet the criteria—go around!
- Land main wheels first(...2...3...4...) then the nose. Not flat, and definitely not nose low!
- After a hard landing that sticks (or after any landing, for that matter) keep flying—maintain back pressure on the yoke and keep the nose up and the prop away from the ground!
- Bounced landings will also sometimes happen. Just call it a touch and go—add full power and get out of there—you still get to log the landing!
- **Never** push down on the yoke during the landing phase.

Some of you may not know this, but the “Evil CFI Handbook” requires that we make students go around at random times, but especially during a nice stable approach that looks like it will end in a greaser. You should be prepared to go around during any approach. I challenge everyone to practice at least one go-around on your next flight. If you need more than one to feel comfortable with the maneuver, then do as many as it takes. As you can see, it is the best option in avoiding most prop strike scenarios.

May all of your landings be made on “Tranquility Base!”

Here are some YouTube videos demonstrating what NOT to do:

<https://www.youtube.com/watch?v=x5ZzktAFJK4>

<https://www.youtube.com/watch?v=4rwHaHIQrcU>

<https://www.youtube.com/watch?v=EopI5QLQ5zs>

<https://www.youtube.com/watch?v=NMmHYWjEmkY>

<https://www.youtube.com/watch?v=G9FkYpvTyc>

Fly safely, fly often!