Thomas P. Turner's
Mastery of Flight

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FLYING LESSONS for March 7, 2024

FLYING LESSONS uses recent mishap reports to consider what *might* have contributed to accidents, so you can make better decisions if you face similar circumstances. In most cases design characteristics of a specific airplane have little direct bearing on the possible causes of aircraft accidents—but knowing how your airplane's systems respond can make the difference in your success as the scenario unfolds. So apply these *FLYING LESSONS* to the specific airplane you fly. Verify all technical information before applying it to your aircraft or operation, with manufacturers' data and recommendations taking precedence. **You are pilot in command and are ultimately responsible for the decisions you make.**

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This week's LESSONS:

From an NTSB Final Report posted this week:

> The pilot [of a Beech Musketeer] reported that during landing the airplane bounced multiple times. During each successive bounce, the airplane gained more altitude to the point that the pilot was scared. He added full power to go around, the airplane turned left, and he was unable to maintain control. The airplane impacted a ditch off the side of the runway and sustained substantial damage to the fuselage. The pilot reported that there were no preimpact mechanical malfunctions or failures with the airplane that would have precluded normal operation.
>
> The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's improper descent path which resulted in a bounced landing and loss of control.

See https://thomaspturner.com/wp-content/uploads/2024/03/2024.0202-B23-AR-FINAL.pdf

Pilot-induced oscillation (PIO) occurs when an airplane begins a departure from the desired flight path, and the pilot applies inappropriate, excessive or mis-timed corrections that result in ever-increasing excursions that threaten to force the airplane out of control. In short, the pilot is "behind the airplane" and his/her attempts at regaining control only make matters worse.

PIO can occur in any phase of flight. But it is usually associated with pitch excursions on landing, where PIO may be most catastrophic. As this NASA flight test video shows, PIO can rapidly develop to catastrophic proportions, even in the hands of an experienced test pilot. Airline pilots can enter a PIO; even test pilots flying the first glide tests of the Space Shuttle bounced and entered a PIO event during trials using the test article *Enterprise* (as least I doubt that was a preprogrammed flight test maneuver). Stresses can rapidly damage landing gear and other airplane structures. It can force the airplane off the runway, or out of control in roll or in a stall. Propeller strikes are common in propeller-driven aircraft.

See:
www.youtube.com/watch?v=XHPv0qt03aA
https://www.youtube.com/watch?v=zxWs9TWfRLA
https://www.youtube.com/watch?v=EcQzlXsw1ko

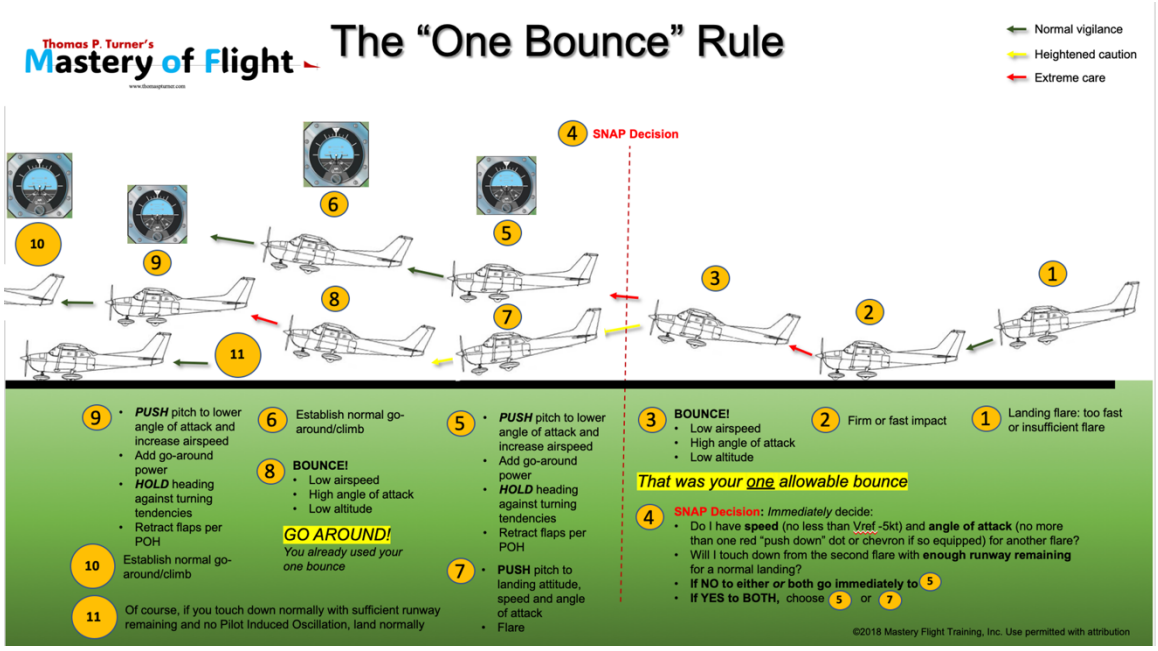
Bounce a landing and PIO becomes a real possibility. As the videos show, once a PIO begins your best option is to power up and go around (well, not in the Space Shuttle). Find yourself in the air at a dangerously low speed and high angle of attack and you may have difficulty maintaining directional control due to propeller turning tendencies.

Add go-arounds after the main gear touches the ground to your recurrent training regimen. Be well-practiced in establishing the right pitch and angle of attack, while firmly holding the proper attitude to prevent PIO. Attitude and power determine airspeed; airspeed provides airflow that creates control authority.

There are two kinds of go-around, and most instructors only teach one. It's comparatively easy to power up, pitch up and clean up from a point a couple hundred feet above the runway lights. It's quite another task to go around once the mains have touched, the speed is low and the angle of attack is very near a stall.

My first instructors presented touch-and-goes as pseudo go-arounds. It wasn't considered a touch-and-go if the nosewheel of the Cessna T-41A touched the ground. We were learning the skill of aerodynamic braking because some of us would go on to fly Air Force fighters. But we were also learning the art of the on-runway go-around, with a liftoff in a condition that necessitated a firm push forward on the controls with power application, then finesse as flaps were retracted and flying speed restored. In short, ***we learned how to recover from PIO***.

After my Air Force experience, and seeing what my early students did after a bounced landing even on a very long (for a Cessna 152) runway, I developed what I call **The One Bounce Rule**.



See https://thomaspturner.com/wp-content/uploads/2024/03/One-Bounce-Rule.pdf

Basically, The One Bounce Rule is this: If you bounce a landing, make a snap decision:

- *Immediately* decide whether you have the **speed** (no less than five knots below your final approach "V_{REF}" speed) **and angle to attack to recover** into a second flare.
- *Immediately* decide whether there is **sufficient runway remaining** to come to a stop from the point you'll touch down a second time, given the airplane and environmental conditions that exits at the time.
- If the answer to either is "**no**" or you have any doubt, **go around** immediately. ***PUSH and HOLD*** to acquire the proper airspeed, angle of attack and coordinated wings-level heading.

- If the answer to both is "**yes**" and you elect to do so, ***PUSH and HOLD*** into a second **flare**.
- If you **bounce a second time**, **go around** immediately. No hesitation, no questions asked. ***PUSH and HOLD*** to acquire the proper airspeed, angle of attack and coordinated wings-level heading.

See http://www.flightsafetyaustralia.com/2016/07/push-and-hold/

If a propeller strikes the surface it's another story. Prop strikes can cause immediate, catastrophic engine damage or propeller damage that makes a go-around incredibly risky. They can also cause internal overstresses that will become a catastrophic failure at some point dozens or hundreds of hours in the future, usually without warning.

Most engine manufacturers recommend engine tear-down inspections after a propeller strike. One manufacturer considers a tear-down mandatory if the propeller speed is seen to drop any at all when the strike occurs, and even if a prop strike occurs when the propeller isn't turning (for example, a towing accident) if the damage is substantial enough the propeller must be removed from the airplane for repairs.

Attitude is everything, at least where PIO recovery is concerned. Practice so that you are able to nail the proper attitude to fly out of a bounced landing into a second flare if it's advisable, or into a go around as you add power and gradually clean up the airframe (retract flaps and landing gear consistent with type-specific considerations).

If you've bounced a second time or if there is any doubt about being able to re-flare and land on the remaining runway after the first bounce. Follow **The One Bounce Rule**.

Questions? Comments? Supportable opinions? Let us know at mastery.flight.training@cox.net.

Debrief: Readers write about recent *FLYING LESSONS:*

Reader Dan Drew writes about last week's *LESSONS*:

> I enjoyed this week's article on downwind vs upwind takeoffs. This brought back to mind this last Christmas when we flew into Sedona, Arizona for the first time in our F33A. Arrival was a non-event and we had a wonderful time enjoying the beauty of the area for a week. On departure I started watching the weather, clear and a million, but the wind was out of the northeast at 8 gusting to 14. Conventional wisdom there is to land on Runway 3 (up slope) and depart on Runway 21 with a downslope if the wind allows. The airport personnel even commented about it but they also added, "whatever you need to do." I use the Bonanza Performance App and it gave me numbers that, although doable off of 21, the wind caused an increase of about 300 feet takeoff roll vs going uphill on 3 into the wind. In the airline world we had charts and computers that took the slope into account but not so much in the GA world.
>
> As you know there are some pretty hard obstacles surrounding the airport and a takeoff on 3 requires a turn over the town. My plane is normally aspirated and I do not have much experience in the high country so my concern over the power level was probably higher than the power I was

> making. **I just don't think many think about the slope that much as they do the wind and definitely not the combination.** Obviously we made it but put a pretty big noise imprint over the town in our turn and climb out.

See:
https://thomaspturner.com/wp-content/uploads/2024/02/2024.0229-FLYING-LESSONS.pdf
https://pohperformance.com/Bonanza/index.html

Thank you, Dan. Reader and retired airline pilot Larry Olson continues:

> As usual, great article on tailwinds. I could make an argument for **managing tailwinds**. Set a limit and know how it would affect the plane, and use accordingly.
>
> My limit is 10 knots, as are most airlines. All things normal, I'll accept up to a 10 knot tailwind for convenience for the most part. Often at my home airport accepting those limits saves miles of taxiing and several minutes of time and circling approaches.
>
> Now, I do temper this with good conditions and runway length, however most of the airports I patronize have long runways.
>
> I found tire wear is a small issue, almost imperceptible, and brake wear is only dependent on when it's needed, which is rare on long runways. Now, short strips are an entirely different issue.
>
> Food for thought.

Most Pilot's Operating Handbooks include takeoff and landing performance data for up to 10 knots of tailwind component, including the Beech Baron 58 you fly. That value is probably arbitrary, but I used some calculations using such charts. My larger concern is flying so others can predict where I'll be to make collision avoidance more likely. Your statement is correct, though; it's possible to manage most flying risks, and the performance impact of tailwind takeoffs and landings is among them. Thank you, Larry.

Reader and well-known instructor/airshow pilot Doug Rozendaal wraps it up for this week:

> Some more discussion points on the downwind landing. I don't get too worried about tailwind takeoffs; most of my airplanes have incredible performance, except for the [Meyers] OTW, and mostly I operate on long paved runways.
>
> **Unless one practices downwind landings, they do not usually go well.** It is a totally different sight picture. A downwind landing will almost always result in a touchdown far beyond the intended point. This is because **a glide path that appears normal with a tailwind will actually be too steep resulting in it being too fast**, which means the airplane accelerates, pushing the airplane on the runway resulting in a nose first landing at higher ground speed can be disastrous.
>
> The opposite of that is that **the pilot feels like they are going to fast because of the perceived ground higher ground speed, and they get too slow**. This happens in the base to final turn with predictable results.
>
> In a tailwheel [aircraft] **the increased ground speed vs airspeed dramatically increases the likelihood of ground loop** and **the decrease airspeed vs ground speed reduces rudder and adverse yaw authority at a higher ground speed**.
>
> If we have an airplane that lands at 50 and a 10 knot wind, that means our touchdown speed goes from 40 to 60 which **nearly *triples* energy**. If control is lost because of a ground loop, nose wheel or tailwheel, and an accident occurs, that increases severity of injuries by an even greater margin. Somewhat counterintuitive, **the slower the airplane lands, the greater the risk of downwind landings**. A 10 kt tailwind to headwind is 50% of the landing speed. In a 60 kt landing it is 33%. Huge difference.
>
> All of these are a big part of why **turning back from an EFATO [engine failure after takeoff] is a really bad idea**.

Excellent dive into the physics of downwind landings. Thank you, Doug.

More to say? Let us learn from you, at mastery.flight.training@cox.net.

See https://nafi.memberclicks.net/join-nafi-now

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