Thomas P. Turner's
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FLYING LESSONS for September 12, 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:

Last week the U.S. National Transportation Safety Board (NTSB) published its Safety Alert (SA) 091, "Know When to Feather Your Propeller If One Engine Loses Power."

Obviously written for pilots of multiengine airplanes, SA091 discusses two topics: **correct responses to partial power loss** as opposed to total failure of one engine, and inflight hazards associated with propeller "start locks," otherwise known as **propeller antifeather locking pins**.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-091.pdf

We've covered partial engine failure many times in *FLYING LESSONS*. We've covered the antifeather locking pins also, but since aviation media and online bulletin board response suggests this design feature of most piston twins is not well known this week's *LESSONS* will focus on that part of the NTSB Safety Alert.

In late 2004 I wrote an article on this feature called "**The Propeller Unfeathering Trap**" that was published online by the now-defunct www.pilot.com. The article was quickly repeated on www.studentpilot.com where it still exists as of this writing. I've revisited this topic elsewhere over the years in *Aviation Safety*, AVWeb, the *American Bonanza Society* magazine and more.

I recall a phone call from the Federal Aviation Administration almost immediately after publication and a conversation that resulted in an FAA Information for Operators (InFO) sheet on **avoiding "the trap."** I can't find the FAA advisory and it may have been withdrawn; the information, in condensed form, is now included in the Transition to Multiengine Airplanes chapter of the FAA's *Airplane Flying Handbook.*

See:
https://studentpilot.com/2005/01/09/the-propeller-unfeathering-trap/
https://www.faa.gov/sites/faa.gov/files/regulations_policies/handbooks_manuals/aviation/airplane_handbook/14_afh_ch13.pdf

To support the NTSB's Safety Alert and preserve this discussion of the hazard and some mitigations, here's my original 2005 article in its entirety:

The Propeller Unfeathering Trap

JANUARY 9, 2005~ THOMAS TURNER

Propellers on most multiengine airplanes, and even some singles, have an unique capability to feather, to be brought to a stop in the event of an engine failure. This dramatically reduces drag, as the stopped blades twist to nearly align with the slipstream and no longer present a disc to the relative wind. The result is substantially improved glide performance for those few feather-capable single engine airplanes, and the difference between a slight climb capability and a steep descent in most piston twins. But there's a trap that may befall the pilot of a feather-capable airplane if an in-flight engine restart isn't successful. How can we avoid the propeller unfeathering trap?

Controllable Props 101

Controllable-pitch propellers come in several forms, but the vast majority share a common design. Prop blade angle is controlled by the motion of a piston inside the propeller dome. This piston, in turn, is moved by oil pressure on one side, and a spring (sometimes augmented by a charge of compressed air) on the other. As oil pressure changes the piston moves and the blade angle changes through gearing between the piston and the blades themselves.

In single-engine airplanes the gearing is designed so that if oil pressure drops below a minimum value the blades twist into the low pitch/high propeller RPM position. The logic is that an oil leak or engine failure will spring-load the prop to the high-speed position for as long as the engine is putting out any power-not a bad idea when flying behind a single powerplant.

In multiengine airplanes, however, there's one or more other engine(s) that may be able to keep the airplane aloft so long as drag is reduced on the 'dead' engine side. It twins, then, the prop logic works the other way-if oil pressure drops below a set minimum the propeller blades drive to the HIGH PITCH/LOW RPM position. In most twins the propeller goes to so high a pitch they flatten out (relative to their direction of rotation) and drag increases to the point the propeller stops completely. The prop 'feathers,' twisted to the lowest-forward-drag position to permit maximum flight performance on the remaining, 'live' engine(s).

You can feather a propeller manually as well, done as part of the engine failure procedure. After detecting and confirming a failed engine, and exhausting all restart attempts (assuming you have altitude and time to try a restart), pull the propeller control handle through a detent to the FEATHER position. This opens a valve that dumps all oil from the prop dome and drives the blades into feather.

Unfeathering, and Accumulators

In almost all cases a pilot who feathers a propeller should land at the earliest opportunity on remaining power, leaving the 'dead engine' propeller in this lowest-drag position. Training for the multiengine rating, however, requires at least one actual engine shutdown and prop feathering in flight, and so also calls for an in-flight restart and unfeathering to resume training and avoid the heightened risk of a real-world single-engine landing.

Unfeathering the propeller involves making sure fuel, ignition and air are available to the engine, then moving the prop control out of the feather position. The procedure should not be rushed; use the appropriate checklist to get it right. Oil again flows to the prop dome and the blades twist out of feather. Once they're in a low rpm position slipstream air may cause the propeller to slowly spin up, which also spins the engine's gear-driven fuel pump and magnetos and restarts the engine. Sometimes air force isn't enough to get the propeller spinning again, and the pilot must 'bump' it around a few times with the starter before it'll unstuck from feather.

This is where unfeathering accumulators come in. An unfeathering accumulator is simply an oil sphere or cylinder, usually mounted in the engine nacelle behind the firewall. A dedicated pump in the engine's oil system crams oil into the accumulator under high pressure. Inside the accumulator this oil pushes against one side of a diaphragm and is opposed by a charge of pressurized air on the other side.

When a propeller is feathered and oil dumped from its prop dome, an accumulator valve is also closed, trapping the accumulator oil. When the prop control moves forward out of feather, the accumulator valve opens and this high-pressure oil, boosted by air pressure on the other side of the accumulator, rushes back into the propeller dome to rapidly twist the prop blades to a high-rpm position where they spin more freely in the slipstream…making the restart much easier.

INSIDER'S TIP: Although unfeathering accumulators are often marketed as a 'plus' for all multiengine airplanes, their true value (offsetting the added weight and complexity of a pair of accumulator systems on a twin-engine airplane) is seen best in airplanes used for multiengine training, where in-flight shutdowns and air restarts are an everyday necessity.

Anti-feathering Lock Pins

If you've ever feathered a propeller in flight you know it does three things in addition to reducing drag. First, it looks weird-there's something unnerving about looking out there and seeing the blades stopped while thousands of feet above the ground. Second, it causes vibration-the engine shakes and rattles in its mounts as the prop comes to a halt against the prop dome's oil-free stops. Third, it makes it difficult to get a restart without accumulators, as the prop-dome piston and gears move without benefit of internal lubrication.

Hence, it is undesirable to feather unless dictated by an emergency or a specific training objective.

To keep some oil in the prop dome and avoid all this friction and vibration every time you shut down the engines, each prop dome contains devices to keep the blades out of feather on the ground. These devices are called the propeller anti-feathering lock pins. Held out of contact by flyweights when the engine is running, the lock pins engage when propeller speed drops to between 600 and 800 rpm. In an in-flight emergency or training scenario with air load driving the propeller blades, moving the prop control to feather causes the prop blades to twist to feather pitch before the lock pins engage-and the propeller feathers. During a normal, on-ground shutdown, however, the air load is absent and when the engine stops the prop reduces speed slowly enough that the anti-lock pins drop into place as the rpm drops through the 600 – 800 rpm range. The prop blades will twist no further, so they don't go into feather. No vibration, no friction on oil-starved prop dome gears, and no cranking against dry metal on the next start-up.

The Propeller Unfeathering Trap

These anti-feather lock pins, vital to long-term health of the propeller mechanism, present a potential trap for the unwary pilot. Let's say you've shut down an engine and feathered its propeller, whether for training or in a real-world emergency. Now you've handled the exercise or resolved the malfunction and are going to attempt an in-flight engine restart.

WARNING: Never attempt a restart following an unexpected engine failure when the cause of the failure is unknown or may cause further damage or a fire.

You process the appropriate checklist and move the propeller control forward out of feather…and the propeller begins slowly ticking around. Something's wrong with fuel flow, induction air or ignition, however, and the engine won't roar back to life. If the propeller isn't spinning above 600 to 800 rpm, the anti-feather lock pins will drop into place and you cannot re-feather the prop. Where you were airborne under control in a low-drag configuration before the attempted restart, now you're aloft with a high-drag, windmilling propeller, with far less aircraft capability. Your training exercise has become a real-world emergency, or the successful outcome of your shutdown-driving emergency, at first safely handled, is now definitely in doubt.

You can't get 800 rpm out of a propeller with the starter. If you are very lucky you might be able to spin the prop to that rate with air load in a high-speed dive (assuming you've got the altitude), but that's not certain or safe either. Your best bet is, in an actual in-flight emergency, to dismiss thoughts of an engine restart unless you're certain your earlier failure came from an in-flight repairable situation (example: running an auxiliary fuel tank dry when you have ample fuel remaining in a main tank). Even then, don't assume the relight will come off as planned. Wait until you're over a runway and in a position to land in case your restart leaves you with a dead, windmilling propeller.

Same goes for shutdowns during training or checkrides. Be sure you're at a safe altitude and near an adequate runway before shutting the engine down, and stay there, in a position to land, in case your practice air restart doesn't work.

BOTTOM LINE: If you feather a propeller 'for real,' do not attempt a restart unless you're absolutely certain the engine will restart. If you get a propeller out of feather and the engine won't restart, you may be in a far worse situation than if you were in before.

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

Debrief

Two readers pointed out that the density altitudes discussed in [last week's *LESSONS*](https://thomaspturner.com/flying-lessons-weekly/flying-lessons-for-september-5-2024/) were excessively high. I doublechecked using a different online calculator and found that to be the case—the fault is mine for not applying more **healthy skepticism** when I put the report together. The true figures: If the surface temperature was 70° Fahrenheit (about 21° Celsius) the density altitude would have been about around 6900 feet. More likely the temperature at the airport was closer to 85°F/30°C the density altitude would be about 8000 feet.

The impact of this difference is minimal: computed ground roll distance using short-field technique including maximum braking is only 135 feet (41 meters) less than cited last week, and maximum-performance distance to land is only 190 feet less. The final approach true airspeeds in last week's report were correct, and all my conclusions in last week's report remain valid. Online copies of the September 5, 2024 *FLYING LESSONS Weekly* are updated. Thanks, readers.

See https://thomaspturner.com/flying-lessons-weekly/flying-lessons-for-september-5-2024/

Reader, instructor and accident investigator Jeff Edwards, who lives not far from the accident site in last week's *LESSONS*, writes:

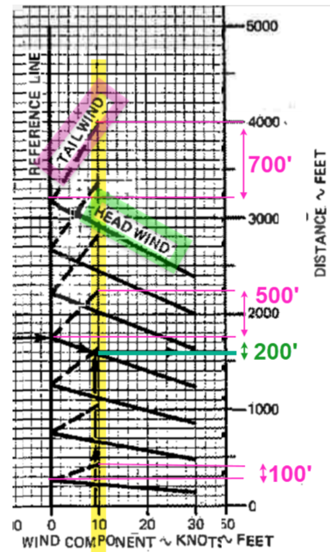
> Great piece on the tragic Cessna 206 accident near my home in Idaho. The flying wisdom around here is:
>
> (1) **get training from qualified back country instructors** like Lori MacNichol, Amy Hoover,
>
> (2) **fly in the morning** when it is cool and calm. Much of the time the afternoon orographic winds pick up like on the accident day.
>
> (3) **know your go-around point** if you have the option to go around, some strips do not have that option.
>
> Many accidents here involve pilots with no or little experience flying in challenging terrain and weather conditions. **Training is the key to staying alive in the beautiful backcountry**.

Great pointers, Jeff, and thanks for the specific instructor suggestions. To your third point: every airstrip or runway has a go-around point; it's just that in some cases that point is much higher than short final, perhaps 1000 feet or more above ground level. Sometimes the go-around point is before you begin the approach. This is especially true under conditions (preliminarily) reported to exist at the time of the accident.

See:
https://mountaincanyonflying.com/about-us/about-lori-macnichol
https://www.linkedin.com/in/amy-hoover-ph-d-cfii-aa353430

Reader Henry Fiorientini adds:

> Thanks as always for insight and instigation of thought, in the case “how much tail wind is too much?” This affects me regularly as my home airport KPWK [Chicago Executive] is just North of Chicago O’Hare International, and they land [using Runway]16 (5,000 feet long) even with a modest amount of tailwind component, for obvious reasons. They have other, shorter runways at KPWK, but the question “Is that tailwind really that much of a detriment?” is one I live with all the time, also since my favorite Wisconsin airport often has [a] mild tailwind for my preferred RNAV approach.
>
> For my analysis, it was simply a matter of “How much EXTRA runway would I need for a nominal 10 knot tailwind, vs ‘calm.’” So **I pull out my POH**, and per the graphic the worst case exemplified is an extra 700 feet, the least is 100 feet, depending on weight, density altitude, etc. So I assume “500-600 feet for every 10 knots of tailwind,” and effectively **treat it like a shorter runway** for landing, and the question remains “Is this Runway long enough for me to land on?” Reasonable?



Yes, that’s reasonable. I suggest all readers follow POH guidance and come up with a reasonable tailwind strategy for the airplane[s] they fly. Thank you, Henry.

Prolific aviation author and instructor (and some time ago, my editor at the long-gone *Private Pilot* magazine) LeRoy Cook continues:

> Great discussion on the Johnson Creek 206 wreck. I teach an "open window" concept for short-field landings. "Imagine," I say, "that there's an open window at the end of the runway, 75 feet wide and 50 feet high (assuming no obstructions). **Your job is to fly the airplane through that window, on speed, stabilized and configured. If you miss the window, go around**." And we'll ***practice the go-around to get it right***, first at altitude, then for real.

That’s another way of saying **in the slot**…and the more ways we can describe a concept, the more ways find to explain it so one “sticks.” Thanks, LeRoy.

Reader, instructor and past Trans World Airways captain Tom Rosen makes it personal:

> [The pilot of the accident Cessna] was a very active Liga volunteer pilot with considerable experience flying into many of the remote strips of Baja and the Mainland of Mexico. I was very surprised that his flying career ended the way it did.
>
> Your report provides more information about the conditions present at the time of the accident. **Operating any plane at high DA [density altitude] in the landing pattern is a very dangerous environment.** Your groundspeed is phenomenal and the pilot’s brain has difficulty processing his visual picture. **Flying a normal pattern will ALWAYS result in a significant overshoot** and a high and fast final. With a 20-knot tailwind it’s impossible.
>
> **This is a common scenario when pilots with little or no high DA and/or mountain flying experience venture into back county airstrips without adequate training.** It’s a tragedy.

It *is* a tragedy, TR. I’m very sorry for your loss, and the loss to the humanitarian pilot community.

See https://www.ligainternational.org/Web/LIGA/Pages/Pilots/Pilots.asp

Reader Richard Wetherell, who I believe also knew the T206 pilot, writes succinctly:

> Too much over confidence.

We don’t know the full details of the accident, but if preliminary information is correct it may come down to your analysis. Thank you, Richard, and please accept my condolences.

Reader Stanley Stewart, who notes he has owned a Beech 35-A33 Debonair for over 44 years and flown it over 3200 hours, and that he is 80 years old, wraps up our Debrief this week with some practical advice that comes from his experience:

> Reading this week's Mastery of Flight™ about the Cessna pilot who attempted to land mid-field with a tailwind in high density altitude conditions reminded me of **a similar landing I observed** years ago at Fallbrook, California (L18). The pilot of a Cessna 206 landed at or beyond mid field on the 2160-foot runway and ran off the end of the runway. **I kept expecting the pilot to go around** when he was too fast to set it down prior to or beyond mid field on the short runway, **but he didn't, and could not stop on the remaining runway.**
>
> **How can we train pilots to go around when the airplane in not** "**in the slot**" as you describe at 500 foot AGL on approach to land? And then **not to try to land when too fast and too far down the runway**. It is disturbing to see or read about this type of accident, what are those pilots thinking? One of the elements of learning to fly and being a safe pilot is aeronautical decision making. Somehow, **we, the pilot community, have to do better on aeronautical decision making**. Too many accidents happen as the result of poor decisions on the part of the pilot.
>
> As my insurance requires a flight review every 12 months, I have had quite a few flight reviews in the last few years. I consider these **flight reviews "training"** and **go to a different instructor each year because they cover different things** in the oral portion (which is why I go to a different instructor each time after reviewing the V-speeds and emergency procedures for my airplane in advance and also reviewing the ABS online training material for my model and configuration), but the flight reviews always include short field takeoffs and landings, which I consider to be not difficult in the wonderful Bonanza/Debonair type aircraft I fly which do not tend to float on landing when using the correct configuration and approach speed, and get off nicely when the correct configuration and speeds are observed on takeoff.

Not only you, but the Federal Aviation Administration considers the required Flight Review to be "training." Quoting 14 CFR 61.56, with my emphasis added:

> "…a flight review consists of a minimum of 1 hour of flight ***training*** and 1 hour of ground ***training***."

Great attitude, Stan. I hope you can continue flying safely for many years more.

See www.bonanza.org

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

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Thomas P. Turner's Mastery of Flight

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