FLYING LESSONS for May 2, 2013

Suggested by this week's aircraft mishap reports

FLYING LESSONS uses the past week's mishap reports to consider what *might* have contributed to accidents, so you can make better decisions if you face similar circumstances. In almost all cases design characteristics of a specific make and model airplane have little direct bearing on the possible causes of aircraft accidents, so apply these *FLYING LESSONS* to any 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 time we continued our discussion with the third most common cause of fatal general aviation crashes, according to the NTSB: engine failures not resulting from fuel management. Although my personal research into some makes and models of aircraft reveal that fuel starvation and exhaustion account for the vast majority of engine failures**,** NTSB finds that is not true of the fleet as a whole (fuel management is #7 on the NTSB list).

See www.mastery-flight-training.com/20130425flying_lessons.pdf

In last week's report we focused on techniques for dealing with total engine failure in flight, both in single- and twin-engine aircraft. We expanded upon surviving an engine failure, which depends on meeting these Three Objectives:

1. Maintaining control of the aircraft during engine-failure flight,
2. Restarting the engine if possible, and
3. Landing under control at the slowest safe speed

During a Mastery Flight Training presentation in Australia last March, one of the pilots made a comment from the front row to this effect: We talk about engine failures and engine-out techniques. But we almost never address partial power loss in flight instruction; we do not evaluate the pilot's ability to recognize and properly react to a partial loss of power during Practical Tests for pilot certificates and ratings. And yet, partial power loss is at least as likely as a total, catastrophic failure.

During that same visit Down Under I was privileged to spend an afternoon in the headquarters of the Australian Transport Safety Bureau (ATSB), and left with a box full of ATSB-generated educational materials. One of the most interesting reports is *Avoidable Accidents No. 3: Managing Partial Power Loss after Takeoff in Single-Engine Aircraft*. The Introduction to this report tells us ATSB's data "shows that during takeoff and after takeoff, a partial power loss is three times more likely in today's light single-engine aircraft than a complete engine failure."

See:
www.atsb.gov.au
www.atsb.gov.au/publications/2010/avoidable-3-ar-2010-055.aspx

Furthermore, the ATSB guide continues, "there have been nine fatal accidents from 2000 to 2010 as a result of a response to a partial power loss compared with no fatal accidents where the engine failed completely." Roughly one fatal mishap a year may not seem significant (it is to the airplane's occupants, their families, friends and co-workers). The interesting point is the disparity between partial power loss fatalities and those that (didn't) result from total engine failures on or shortly after takeoff. Total engine failures happen, according to ATSB, it's just that they haven't resulted in deaths like partial engine failures have done.

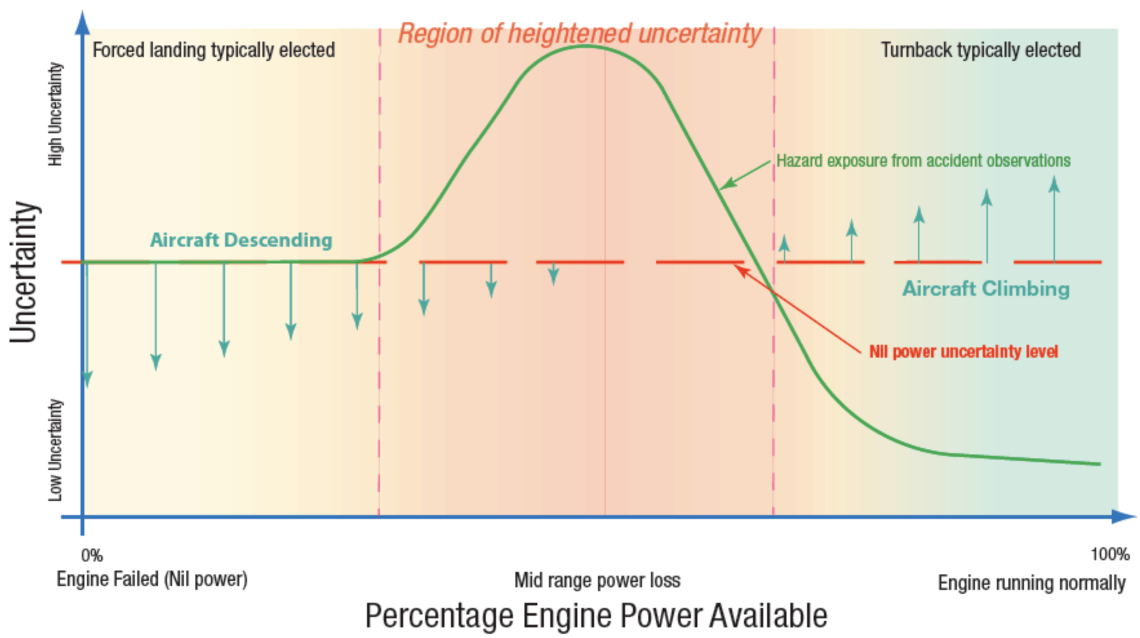
I won't repeat the entire ATSB report; downloading and reading the 29-page report is your *FLYING LESSONS* homework for the week. I will reiterate, however, a portion of the ATSB's summary:

- Many partial power losses could have been prevented by thorough pre-flight checks. Some conditions reported as causing partial power loss after takeoff are fuel starvation [presumably due to contamination, and not draining a tank dry—tt], spark plug fouling, carburetor icing and pre-ignition conditions. In many cases, these conditions may have been identified [before takeoff].

- Considering actions to take following a partial power loss after takeoff during the process of planning and the preflight safety brief gives a pilot a much better chance of maintaining control of the aircraft…. Considerations include planning for a rejected takeoff, landing immediately within the aerodrome, landing beyond the aerodrome, and conducting a turnback toward the aerodrome.
- If nothing else, maintain glidespeed and plan a maximum bank angle…you will not exceed if a turnback is an option. Be prepared to reassess the situation throughout any manoevuvre.

See www.atsb.gov.au/publications/2010/avoidable-3-ar-2010-055.aspx

This brings us back to the Three Objectives for engine failure…which are just as valid for a partial power loss as they are for total engine failure. The challenge, then, becomes: *When do I know I've had a partial power loss?*



ATSB's research shows that a slight power loss after takeoff (toward the right of the ATSB chart above) may not be enough to prevent a safe return to the aerodrome, er, airport, for a (fairly) normal landing. Conversely, a nearly total engine failure (toward the left of the chart) gives the pilot little choice to descend, and at least in Australia's recent history the pilot usually continued straight ahead…and survived.

The Region of Heightened Uncertainty, however, is where engine power loss is substantial but not yet complete. This creates an "uncertainty" on the part of the pilot: "Do I really have an engine problem?" "How bad is the power loss?" "Can't I just coax the airplane up to a safe altitude and figure out what's happening?" "Should I make a fast turn back to the runway?"

"The course of action chosen following such a partial power loss…can be strongly influenced by the fact that the engine is still providing some power, but this power may be unreliable. [You may] have a strong desire to return the aircraft to the runway to avoid aircraft damage associated with a forced landing…. The complexity of decision making in such circumstances is further compounded by the general lack of discussion and training on [the topic of partial power loss].”

ATSB suggests several ways to prevent a partial engine power loss (read the report), and a familiar-sounding technique for managing a partial engine power loss if it occurs (simplified somewhat here):

- Lower the nose to maintain glide speed.
- Troubleshoot the engine only if there is sufficient time.
- Maintain glide speed and assess whether the aircraft is maintaining, gaining or losing altitude to gauge current aircraft performance and determine options available for landing.
- Fly the aircraft to make a landing given the aircraft’s height and performance.
- Make no turns below 200 feet AGL.
- Land the aircraft.

This sounds very much like the Three Objectives for total engine failure detailed last week.

Surviving a partial power loss, then, seems to ride on identifying that the engine has lost some power in the first place. Only then can you employ the technique for managing the loss. So how can we detect a partial power failure on takeoff?

Try this exercise: With an instructor or trusted pilot as a safety observer, and to record information for post-flight review:

- Make a series of normal and short-field takeoffs.
- On each of those takeoffs, use care to fly the desired airspeed—V_x for short field, V_y for a “normal” takeoff and, if you routinely do so for engine cooling or a cushion of airspeed for control when no obstacles block your departure path, a $V_{climbout}$ speed of your choosing.
- For each takeoff, record the pitch attitude that results in the target speed. Record both the Attitude Indicator indication, if your airplane is so equipped, and your subjective description of the attitude as seen out the front of the airplane (“top of the cowling on the horizon”, etc.).
- Record the approximate rate of climb for each attitude/airspeed combination.

Now climb to 5000 – 6000 feet above sea level (unless your home airport is already at or above that height).

- Adjust the mixture, in piston-powered airplanes, so that it is at the maximum horsepower position at full throttle…which is approximately how fuel flow will be set for a real-world high density altitude takeoff.
- Repeat the departure exercise by simulating a takeoff run in the takeoff configuration (flaps and gear per your routine), establishing the target airspeed and raising the nose to the V_x, V_y and $V_{climbout}$ attitudes on successive “takeoffs.”
- Record the proper attitudes (indicated and subjectively visual) for high density altitude departures.
- Record the approximate rate of climb for each attitude/airspeed combination.

How is this information useful? If you are precise with hitting an attitude and airspeed target for the type of takeoff (short field, normal and “personalized”), you will have a predictable rate of climb for near-sea-level and relatively-high-density-altitude conditions. The only variables will be airplane weight and turbulence. If you hit your target and the rate of climb is noticeably less than you expect from completing this exercise, then *suspect you have a partial power loss.* Scan the instruments briefly (partial power loss may be reflected in EGT, CHT or fuel flow indications) to see if you have immediate confirmation of a power loss. But do not dismiss the possibility of partial power loss if your initial scan shows no obvious problem.

At that point, follow the ATSB technique of establishing Best Glide speed to see if the airplane is capable of climbing, can only climb slightly or hold altitude, or is losing altitude. This will tell you if you need to aim for the Three Objectives and get the airplane back on the ground.

As promised, here is a suggested annual training regimen for preparing for engine failures including partial power loss on takeoff. Remember these are minimum suggestions, and you don't have to take the entire training at one time—in fact it's better to spread it out over the year so you're never too distant from a good training experience. Note also that the added performance of a second engine comes at a cost (beyond fuel, and insurance, and upkeep…). Multiengine pilots should budget additional time and funds for engine-out training, and in my opinion are not truly prepared to take advantage of the option of continued flight on one engine until they have some experience and regular practice with engine failures during and immediately after takeoff. The only way to get this experience realistically and safely is in a Flight Training Device or simulator.

Pilot Type	Log	Dual	Solo	Task
All	1.0 hour	x		Simulated engine failures in flight
	0.5 hour	x		Exercise to determine glide attitude
	0.5 hour	x		Exercise to determine takeoff attitudes
Multiengine	1.0 hour	x		Simulated engine failures at altitude
	2.0 hours	x		Simulated engine failures on takeoff in a multiengine Flight Training Device or simulator

Comments? Suggestions? Let us know, at Mastery.flight.training@cox.net

Debrief: Readers write about recent *FLYING LESSONS:*

Reader Andy Reardon writes about last week's *LESSONS*:

> Tom, another excellent article, specifically with respect to CONTROLLING the aircraft in engine-out situations. My own experience is that in the event of a power loss in a single -engine aircraft, **the myopic focus is instinctively on maintaining glide speed but paying less attention to the critical requirement of keeping the aircraft straight and properly trimmed** while addressing restart procedures. Keep it up!

Thanks, Andy. Reader Tony Crescimanno gets into the spirit as well:

> I fly an average of 75 hours per month. Been doing that for the past 27 of my 38 years of flying. Early in my flying career whenever I heard or read about a flying mishap my attitude was usually on the order of, "Gee,

> **how could the pilot have done that?**" or, " Well**, I'd never do that in an airplane**." But with experience came a different response: "**What can I do to prevent that from happening to me?**" Your recommendations for an annual flight training program provide us with a valuable guide to maintaining proficiency and safety. Flight simulators also, full motion or not, will improve our performance during an abnormal or emergency situation. Ground schools aid us in being knowledgeable of and responsible for the aircraft we fly. Completing ground school training, simulator training and flight proficiency evaluations every year for the past 34 I can attest to the value and necessity of an annual recurrent flight training program. **That's what I do to "prevent that from happening to me."** We all fly with a list of priorities. The top of that list must always be Safety.

Thank you also, Tony. If the very high-frequency personal/business pilots out there agree that more training is better, even when they get a lot of "experience" in routine flying, then those of us who fly less should agree we need to train even more. Put another way, as my friend and *FLYING LESSONS* reader Tom Rosen often says, if airline and corporate pilots who fly dozens of hours every month are required to complete strenuous training every six months or no less than every year, then who are we "recreational" and personal use pilots that we feel we can safely operate in the National Airspace System with less regular instruction?

There is no "one size fits all" training regimen for pilots. What the flyer of a Light Sport or VFR single needs is different from the demands of an instrument pilot or one flying a piston twin or turbine. Aircraft crash history tells us, however, that airline pilots sometimes come up short on basic angle of attack and stick-and-rudder skills, and lightplane pilots continue to crash attempting to fly in conditions that cause airline delays and cancellations. So there is some overlap.

In recommending an annual training regimen I'm trying to lay out a differing plan based on the type of flying the pilot does, with these apparently-not-obvious areas of overlap in mind. It's a lot more training than most of us do in a year once we've passed our most recent certificate or rating checkride. You don't have to do it every year—but pledge to do it *this year*, at least, to review the basics, to fill in the gaps in your training (things you never fully explored in the rush to train to Practical Test Standards), and **one year from now to find yourself a year further away from your last checkride a little *better* as a pilot, instead of a little worse**.

Remember, the point of the exercise is to gain experience to avoid situations that time and again have brought better pilots than you and me to a tragic end.

Comments? Mastery.flight.training@cox.net

We've had a great deal of superb commentary and insights from *FLYING LESSONS* readers over the past few weeks, that we've not had space to feature in the weekly reports. Next time we'll defer the Top 10 Fatal Causes discussion and suggestions for an annual training regimen, and focus on recent Debriefing items. We'll get back to the Top 10 discussion in mid-May.

For piston Beech pilots

The Beech Weekly Accident Update is posted at www.mastery-flight-training.com/beech-weekly-accident-updat-2.html.

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Thomas P. Turner, M.S. Aviation Safety, MCFI
2010 National FAA Safety Team Representative of the Year
2008 FAA Central Region CFI of the Year
