FLYING LESSONS for March 26, 2009

suggested by this week's aircraft mishap reports

FLYING LESSONS uses the past week's mishap reports as the jumping-off point 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.

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This week's lessons:

There have been two high-profile aircraft tragedies this week, one near Butte, Montana, the other at Narita Airport, Japan. Although investigations into these horrible events have just begun and it will be a long time (if ever) before we know for certain the proximate causes of each, in the spirit of *FLYING LESSONS* we'll briefly consider some possibilities not in an attempt to explain either of these specific tragedies, but to highlight things we should think about if we ever find ourselves in similar circumstances.

The large, single-engine turboprop crashed near Butte after carrying members of three families from California on a ski trip. Fourteen perished aboard the PC-12. The wreckage was found by investigators to be contained within a roughly 100-foot area, confirming witness accounts that the airplane descended vertically in its final seconds. News photos show the airplane burned ferociously, suggesting it had plenty of fuel on board. The gear was down on impact but the flaps were up.

Very preliminary reports on the focus of the Montana investigation suggest the following *FLYING LESSONS* :

Fuel burn often causes a shift in aircraft center of gravity. Know which way, in what direction, and how far c.g. moves as you use fuel. Although uncommon in most training airplanes, c.g. shift to the extremes or even outside of the flight envelop is fairly common in more capable airplanes, especially those with large cabins or copious fuel systems. Get out your airplane's weight and balance information and the Pilot's Operating Handbook and do some calculations.

- Figure c.g. location with a typical passenger load and full fuel, then half tanks and in a zero-fuel condition.
- If you find your airplane will go outside c.g. limits before you run out of fuel, you need to determine how much fuel you can burn and remain safely within the envelope.
- Under some conditions you may need to fly short hops when fully loaded to stay within c.g. limits, landing to fill up with fuel "ballast" for the next leg.

Stability varies widely with c.g. position, even when within the approved envelope.

- Forward c.g. position increases stability, making for a smoother ride but requiring greater force to change flight attitude, increasing takeoff distance and inhibiting climb. A forward c.g. airplane will be at a higher angle of attack for a given airspeed, increasing drag and reducing cruise speed.
- Rearward centers of gravity reduce stability for a "sportier" feel, but making the airplane wallow in turbulence and more likely to "over-rotate" to a high angle of attack on takeoff or during initial climb. A rearward c.g. airplane will be at a lower angle of attack for a given airspeed, so it'll fly faster in cruise than the same airplane loaded to a further forward center of gravity.

- For more on c.g. see my AVweb article "Leading Edge #18: Achieving Balance".

See www.avweb.com/news/leadingedge/leading_edge_18_achieving_balance_197851-1.html.

Although we most frequently train for stalls on landing, the record shows most deadly stalls really happen at the beginning of a missed approach or go-around climb. See the recent *FLYING LESSONS* report *Know When to Go (Around): Power, Pitch, Configuration*.

See www.thomaspturner.net/2009.0226%20FLYING%20LESSONS.pdf

Airframe ice accumulation is most dangerous during the approach to landing, when airspeed decreases and there's less room to recover. Ice-related mishaps come in five main varieties:

- Hard landings: An airplane heavy with ice, and a wing made less efficient by icing's effects, often has an excessive sink rate on landing, especially if the pilot reduces power as he/she would normally, when making an ice-contaminated landing.
- Stalls: The wings' lift-generating capability is unpredictable when iced, and the effect may not be symmetric to both wings. Stall warning systems and indicators are useless when ice coats the wings. The airplane will stall at a higher indicated airspeed (lower angle of attack), quite likely without "seat-of-the-pants" or through-the-stick warning.
- Tailplane stalls: Tailplane stalls occur when the horizontal stabilizer reaches its critical angle of attack before the wing. The condition is aggravated by flap extension and results in a near-vertical descent, which is why tailplane icing mishaps happen most often occur a few miles from the end of the runway—the point where the pilot extends flaps for landing. The recovery technique is exactly opposite what we're taught about stall recovery—read the recent *FLYING LESSONS* on tailplane stalls.

See www.thomaspturner.net/2009.0219%20FLYING%20LESSONS.pdf

- Instrument-related mishaps: Ice can block static ports or pitot tubes, leading to erroneous instrument indications and, in the case of AHRS-driven "glass cockpit" displays, may generate even more "Red X" failure displays. Instrument sensors must be heated before ice accumulation begins, so activate pitot heat, etc. when you enter *suspected*, not actual, icing.
- Visibility-related mishaps. In some designs forward visibility may be limited to a small section of cleared windscreen through a deice "hot plate" (that may not be directly in front of the pilot), or just above the glareshield ahead of a windshield defrost outlet. In extreme cases you may have to use peripheral vision out the side windows as you near the runway, or even peer out an open pilot's side window if the exterior is completely coated.

If you've iced up and can't remove all the ice before touchdown, plan on landing on the longest available runway, without flaps, flaring little and with extra power all the way to touchdown—all adding to an extra-long "float" and landing roll. Instruments and stall warning may be unreliable; visibility outside may be severely limited. Better yet, don't get yourself (or your passengers) in such a precarious position, by avoiding icing conditions whenever possible and working to remove ice before landing if you've accumulated any in flight—even if this means delay or diversion to shed the ice before arrival.

Recent FAA policy gives pilots more authority—and more responsibility—to plan flights in and near areas conducive to airframe ice accumulation. Read these recent *FLYING LESSONS* on the new rules for flight in icing conditions.

See www.thomaspturner.net/2009.0205%20FLYING%20LESSONS.pdf

The wide-body air freighter landed hard, porpoised and then cartwheeled on landing at Narita, Japan. The crew of two died. Winds were reportedly strong and gusty, although closely aligned with the runway heading.

Graphic video of the crash shows the airplane in a high rate of sink before runway contact. The MD-11 bounced high into the air, its nose coming down first on the second runway strike. As the crew was attempting recovery from the second, severe bounce, the left wing impacted the ground, tearing off in flames as the airplane rolled onto its back.

See http://video.ap.org/?f=1344346&pid=HxfK96GTjmIFZXzotozUto_MtrOm4hL5.

2008 (U.S.) National CFI of the Year (and *FLYING LESSONS* reader) Max Trescott addresses a *FLYING LESSON* to be learned from this video. In his March 22 post he writes:

> According to the FAA's *Airplane Flying Handbook*, "The corrective action for a bounce is the same as for ballooning and similarly depends on its severity. When it is very slight and there is no extreme change in the airplane's pitch attitude, a follow-up landing may be executed by applying sufficient power to cushion the subsequent touchdown, and smoothly adjusting the pitch to the proper touchdown attitude.
>
> "When a bounce is severe, the safest procedure is to EXECUTE A GO-AROUND IMMEDIATELY. No attempt to salvage the landing should be made. Full power should be applied while simultaneously maintaining directional control, and lowering the nose to a safe climb attitude. The go-around procedure should be continued even though the airplane may descend and another bounce may be encountered. It would be extremely foolish to attempt a landing from a bad bounce since airspeed diminishes very rapidly in the nose-high attitude, and a stall may occur before a subsequent touchdown could be made."

Max continues:

> A few years ago, one of the local flying clubs where I teach analyzed their incidents and concluded that fully 70% of them would have been avoided had the pilot initiated a timely go-around. CFIs were directed to instruct clients to initiate a go around whenever they had a bad landing, rather than try to salvage every landing. After this change, the number of incidents dropped off sharply.
>
> The discussion led me to re-examine how I teach landings. I realized that I too had fallen into the trap of teaching pilots how to salvage most bad landings. Yet teaching a go around as a primary response to a botched landing can save bending a lot of metal.

See www.maxtrescott.com/max_trescott_on_general_a/2009/03/federal-express-md11-crash-at-tokyos-narita-airport.html#more

Thanks, Max. I'm going to emphasize go-arounds more myself. Readers, sign up for Max's free emails at www.maxtrescott.com.

We've been discussing runway directional control as a function of controlling the effects of:

1. Wind
2. Runway surface
3. Dynamic aircraft forces (propeller tendencies, tail design, tailwheel, wing loading, etc)
4. Aircraft malfunctions (tires, brakes, engines, controls)

Because of time spent on the tragic but very public events of this past week we'll defer additional discussion until next the issue of *FLYING LESSONS*. There we'll move on to the directional control effect of dynamic aircraft forces that result from ***aircraft design***.

Questions? Comments? Email me at mastery.flight.training@cox.net

Debrief: Readers comment on recent *FLYING LESSONS:*

A recent *FLYING LESSON* on flying maximum-range trips included this statement:

> If the difference of a few minutes' flight makes the difference in making it to destination with adequate fuel reserves, then frankly in my opinion you need to reduce cruise power, fly at a higher altitude for increased fuel efficiency, change your mixture leaning technique, add additional fuel tanks or plan shorter trips. But it's *your* choice as PIC.

Reader and oceanic lightplane pilot Bill Compton responds:

> Tom, I disagree with the advice "fly at a higher altitude for increased fuel efficiency". If maximum range is the goal, altitude doesn't matter. Rather, it is calibrated airspeed (CAS) which matters. The CAS which gives the highest True airspeed/Fuel Flow is best range speed (V_{BR}) for a given weight of the aircraft. That speed is not in the POH, but can be flight-tested for one aircraft weight, then computed for other weights by the formula:
>
> V2 = V1 X square root of Weight 2/Weight1
>
> Using the same fuel flow at a higher altitude gives a higher TAS, and more range, but it is a result of the lower CAS, closer to V_{BR}, rather than the higher altitude. The same increase in range can be obtained by slowing down at the same altitude, but not below V_{BR}.

Put another way, it is the reduced airspeed, not altitude alone, which increases range. Bill has flown single- and twin-engine airplanes single pilot from Alaska to Hawaii and over the Arctic to Europe, so he truly knows what he's talking about. Thanks, Bill, you always make us think!

On the same general topic (achieving maximum range) reader/instructor Bill Cox writes:

> I have been a flight instructor for over 20 years and I have had a few incidents that I have learned from. I don't think it is a very wise idea to cut it that close [running all but one fuel tank completely dry]. I have done it on rare occasions when I know I'm going to need all that I have. I like to tell the story of flying at midnight over the Tehachapi in a late model Mooney with the owner asleep in the back seat. We were IFR on top at 14,000 we had more than enough fuel to make Sacramento (our destination) but I wanted to make sure I had enough fuel showing in the fullest tank to not have to worry about it. The clouds were pretty solid from about 1000 ft above Fresno up to 12,000 ft but when I let the engine quit the owner just about came unglued. Oh did I mention I had a student flying the left seat and the fuel selector valve is over on his side so it took me probably 30 to 60 seconds to get it switched and running again. The owner insisted then that we land at Fresno and refuel even though we had plenty of fuel to make Sacramento. We then spent the next two hours in the clouds at 6000 getting home.
>
> One other thing a friend of mine one time shut off the fuel with a student in a 172 and let the carb run dry. The float valve stuck and he had to make an emergency landing.
>
> Think about it real hard before you make any "on purpose" engine failures because it may not always restart.

Thanks, Bill.

Reader question

A reader writes:

> Hi, Tom, from Australia. We are interested in fitting a Knots2U Gear Alert System to our 1968 E33

Bonanza. I am interested in your thoughts in a couple of areas:

1. Do insurance companies in USA recognise the potential benefit of such a system by offering a reduced premium?
2. As a 60+ year old who has purchased your CD *Those Who Won't*, I like the principle and logic of your presentation but I am a little reluctant to change my habits this late in my life as I feel that change may confuse my old habits and increase the risk to me. What are your thoughts on older people changing ingrained procedures?

I was sorry not to be able to be at your Australian presentation recently but I did see you a few years ago on one of your previous visits.

Kind regards,
David Headlam

Hi, David. I'm sorry you couldn't make Armidale but thanks for attending the earlier event. Addressing your questions:

1. I know of no insurance company that provides a discount for landing gear warning systems. I have a lot of contacts in the insurance industry and will try to get an update (any readers in the industry want to chime in?). Their response will likely reflect whether they have seen a direct correlation between installation of such a device and a reduction in gear-up claims.

2. Thanks for buying the DVD. As you may remember from my earlier presentation, I usually start classroom instruction with a reminder that in all but the rarest cases *there is no one way to fly an airplane*. If you have a procedure that **works**, that **you do consistently**, and is **safe**, then there's no reason to change what you do.

In my early years of instructing I learned there are many ways to fly an airplane and there's no reason for me to try to impose my will just because it's my idea. Put another way, **there's a difference between *procedure*** (a required action, such as landing with sufficient runway remaining, engine temperature management, or extending the landing gear) **and *technique*** (an individual's method for accomplishing a procedure). I present the way things I do them and ask you simply consider my techniques, and the reasoning behind them. You're then free to adopt what you like, modify them as you wish, and throw out the rest. David, if you are consistently getting the gear down and verifying its position before getting too close to the ground, then stick with what's worked for you for so long. Thanks for writing.

See: https://secure5.webfirst.com/ABS/Store/#DVDs

Questions? Comments? Send your insights to mastery.flight.training@cox.net

Fly safe, and have fun!

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