FLYING LESSONS for October 29, 2020

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 almost all 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 a scenario unfolds. 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:

Where we lose it

Ask yourself a question: *where do most stalls occur?* Take a moment. Write down your answer.

Almost everyone probably wrote down "*in the base-to-final turn*." The ubiquitous stall scenario is overshooting the turn from base leg to final approach, and (perhaps subconsciously) adding too much rudder to try to slew the airplane's nose into alignment with the runway centerline in a skidding turn.

The resulting overbanking tendency may incite the pilot to apply aileron opposite the turn. The upward deflected aileron on the wing outside the turn decreases that's wing's angle of attack compared to the wing inside the turn. If the pilot also pulls back on the elevator control in this turn—another instinctive response to an overshoot—the inside wing may reach its critical angle of attack. It suddenly stalls while the outside wing is near its maximum coefficient of lift. The airplane snap-rolls toward the inside of the turn with nowhere near enough altitude for the startled pilot to recover. The folks at Bold Method document this condition nicely here.

See:
www.boldmethod.com
https://www.boldmethod.com/learn-to-fly/aerodynamics/slip-skid-stall/

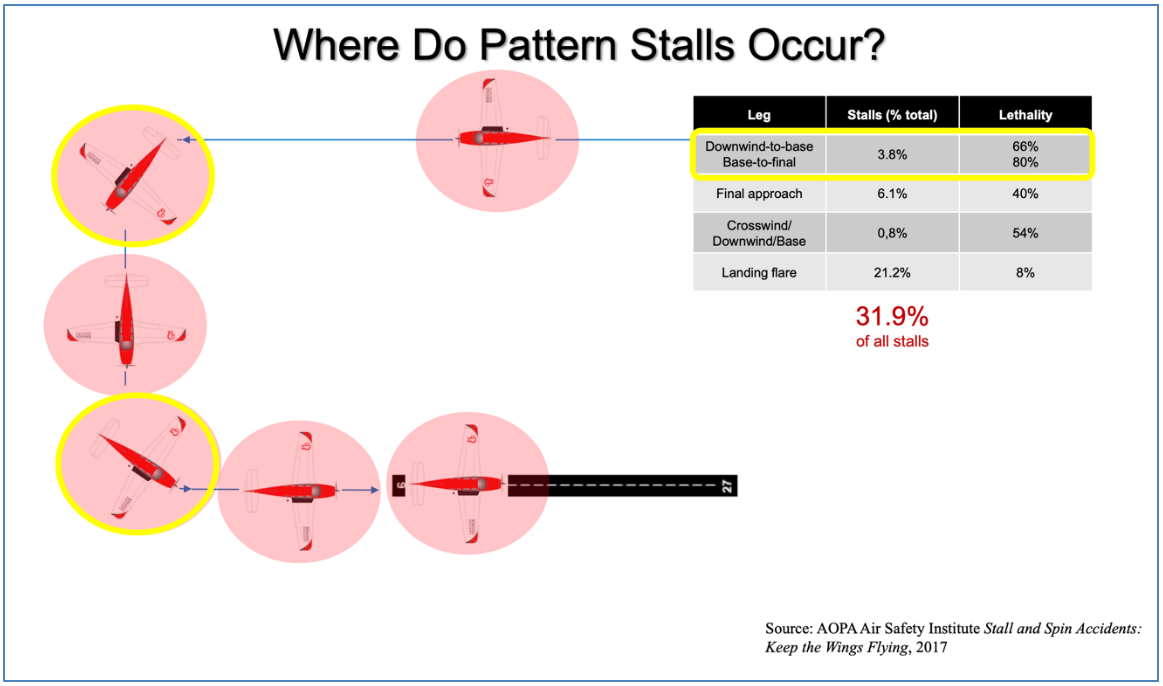
A base-to-final turn gone bad is a deadly Loss of Control – Inflight (LOC-I) scenario. However, LOC-I in the ***base-to-final turn is one of the* least *common stalls in the accident record.***

The truth about stalls was quantified by AOPA's Air Safety Institute in a 2017 study titled "Stall and Spin Accidents: Keep the Wings Flying." This report "analyzes 2,015 stall accidents between 2000 and 2014, and concludes with recommendations for prevention, recognition, and recovery from stalls while offering ideas on a shift in focus for stall awareness, prevention, and recovery."

AOPA notes: "Perhaps surprisingly, more stalls occur during the departure phases of flight (takeoff, climb, and go-around) than in the arrival phases (approach, pattern, and landing)."

See https://www.aopa.org/-/media/files/aopa/home/pilot-resources/safety-and-proficiency/accident-analysis/special-reports/stall_spin.pdf

Using the AOPA-ASI data, which in turn derives from NTSB conclusions, I created some images (courtesy ABS Air Safety Foundation) that describe the true nature of traffic pattern stalls.



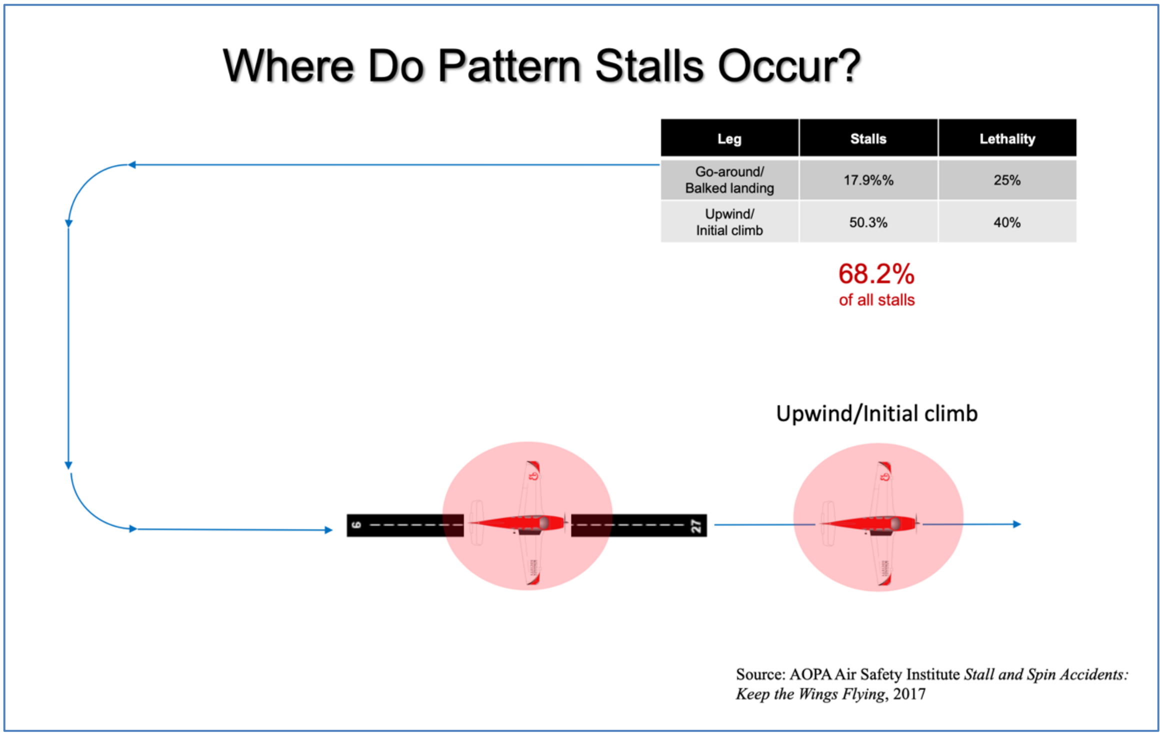
The first image details real-world stall data on the arrival end of a visual traffic pattern. The commonly cited base-to-final turn, and stalls in the turn from downwind to base leg, together account for **only 3.8%** of all NTSB-reported stall events. Now these stalls, when they do occur, are quite deadly: 66% of the downwind-to-base stalls are fatal, and 80% of base-to-final turn stalls result in death. That stands to reason; if a stall occurs in one of these places there is little room to recover. Still, these most commonly considered turns are **low-probability, high-severity events**.

Stalls on the **downwind leg** or the wings-level portion of **base leg** almost never occur, **only 0.8%** of the reported LOC-I events in the circuit. A little over half of these resulted in death, still a **low-probability, high-severity event**.

Stalls after completing the turn to final approach are almost twice as common as stalls in the turns. Still, they account for **only 6.1%** of traffic pattern stalls, 40% of them fatal. This becomes a **low probability but moderate severity** type of event.

Stalls in the landing flare are much more common than any of the others on the arrival end of the pattern: **21.2%** of the pattern stalls total. Close to the ground, these stalls usually do not devolve into spin rotation, and vertical movement stops before the airplane accelerates to a deadly descent. We call these stalls a **hard landing**—only 8% of stalls in the flare kill people. These are **high probability but relatively low severity events**.

Put them all together and LOC-I in a visual arrival account for **31.9%** of all traffic pattern stalls. Another commonality: these are generally **power-off stalls**, the type most pilots and their instructors are far more comfortable practicing, and tend to practice more often.



This second image plots AOPA-analyzed NTSB data to show stalls during a go-around and during initial climb. This is the surprising part: **takeoff and go-around stalls, *power-on stalls*, are far more common than power-off stalls** during the approach and landing. **About 18%** of the reported stalls happened during a go-around. Because these LOC-I events are close to the ground, a quarter of these stalls are fatal…but three-quarters of them are not.

Many types of airplanes, when trimmed for final approach speed, have an elevator trim setting that is more nose-high than the takeoff trim setting. Some types are trimmed *very* nose high on final approach. Meanwhile, in many airplanes adding power causes an upward pitch movement.

So at the beginning of a go-around, many airplanes will pitch up into a high angle of attack. It may take *forward* pressure on the controls to fly the correct initial attitude and airspeed. Pilots who do not practice go-arounds routinely may not be prepared for the control inputs necessary to avoid a stall.

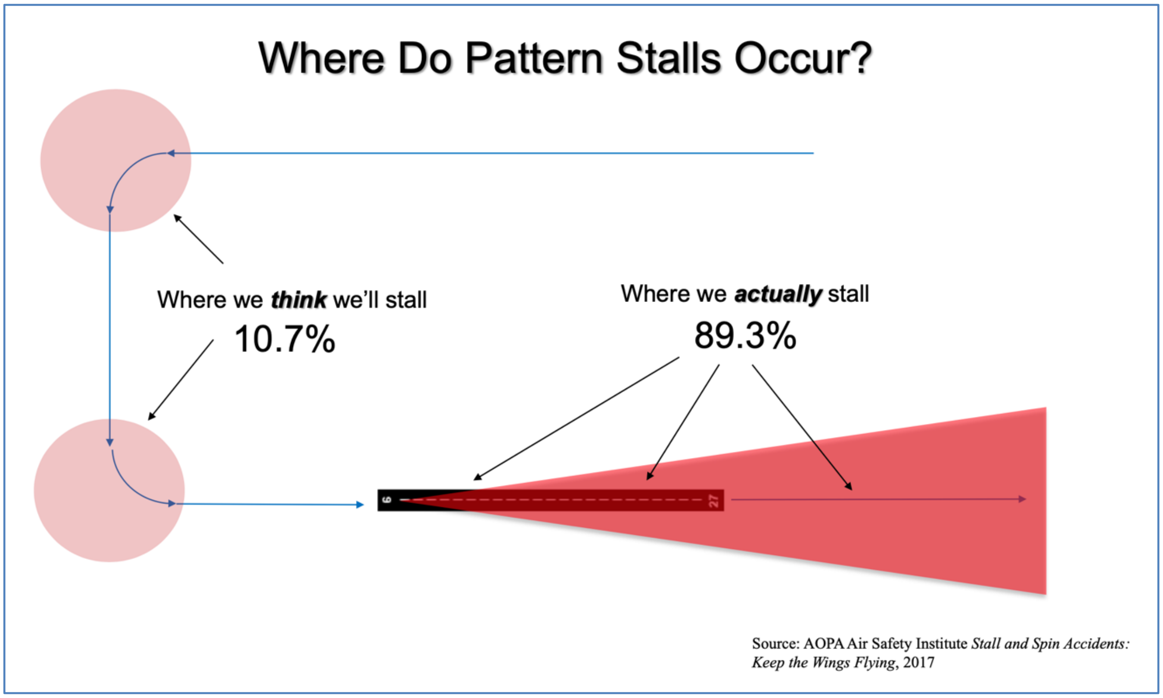
However, half of all traffic pattern stalls happen during takeoff and initial climb. 40% of these losses of control prove fatal. These are **high probability, moderate severity events**.

The major commonality here: these are **power-on stalls**. You know, the ones that are uncomfortable to fly, and may seem unrealistic is flown the way they are prescribed in the Airman Certification Standards. For the stalls that will get you, full power stalls during takeoff or a go-around, are often flown with some flaps and with (in retractable gear airplanes) gear extended.

Such an airplane, combined with nose-up trim, may reach critical angle of attack at a pitch attitude much lower than is required to fly an ACS-style power-on stall (pg. 43). The "dirty" airplane configuration often results in a more dynamic, more dramatic departure from controlled flight than a clean, ACS-style power-on stall. And full power adds to the rapid departure from controlled flight, compared to the often reduced-power power on stall taught at altitude—power application can introduce yaw and roll, and countering that movement with aileron (a common response) sets the pilot up for that same skidding-stall scenario we discussed back in the turn from base to final.

See https://www.faa.gov/training_testing/testing/acs/media/private_airplane_acs_change_1.pdf (pg 43)

My third diagram interpreting AOPA's report compares where we *think* we'll stall to where we *actually* stall, based on NTSB accident history:



About half of all NTSB-reportable stalls are power-on stalls during takeoff and in a go-around. **Almost 90%** of all stalls—add the hard landings to the power-on stalls—happen over or beyond the runway. We *think* if we're going to stall it will be in the pattern before final approach. We *actually* stall over the runway and on the departure end.

We spend a lot of time and effort teaching the power-off stall, avoiding accelerating the stall (pulling back on the controls, which increases G load and therefore angle of attack for a given pitch attitude) and emphasizing rudder coordination to keep both wings at the same angle of attack, avoiding the snap-roll scenario. This emphasis may be why the most commonly cited stall scenario, the base-to-final turn, is in reality one of the *least* common stalls in the accident report. Don't stop training, practicing and thinking about these stalls. **Training and awareness work.**

We need to add training and awareness of stalls over and beyond the runway, and practice realistic simulations of a power-on stall in the landing and takeoff configurations, to guard against the most common stalls. Get as comfortable recognizing and recovering from these stall scenarios as you are with power-off stalls more commonly practiced, to avoid the traffic pattern loss of control threat.

Questions? Comments? Experiences of your own to relate? Send them to mastery.flight.training@cox.net.

Debrief: Readers write about recent *FLYING LESSONS:*

Frequent Debriefer and past airline captain Robert Thorson writes about last week's *LESSONS*:

> The icing diversion article is interesting from a variety of standpoints. I think the issue is [that] GA [general aviation] instrument pilots have little knowledge of the change in regulations regarding flying in forecast icing conditions. Another is knowledge of why GA aircraft have any anti-icing equipment at all. Basic but appropriate for the level of currency and certification. To roughly paraphrase Clint Eastwood, "How lucky are you feeling today?" **Even Airline Captains failed to realize the dangers of ice pellets and freezing precipitation, and still do.**

Every year about this time I start getting phone calls and emails asking how to plan flights in cold-weather conditions. When I advise most pilots to remain outside clouds and visible moisture when outside air temperatures are near or below freezing, many respond "are you saying I can't fly IFR in the wintertime? That destroys the utility of my airplane." My answer: "Yes, that's what I'm saying, if your airplane is not certificated for flight in icing conditions."

I believe most pilots of light aircraft ("light" following the FAA definition, less than 12,500 pounds/5670 kilograms maximum weight) know at least intellectually the icing limitations of their aircraft, and when potential icing conditions exceed the certified limits of their aircraft. There are substantial limitations even to "known ice" airplanes, based on water droplet size and atmospheric moisture content. Fewer pilots actually act on those limitations, however, when it means having to cancel flights. Sometimes nothing bad happens; either the pilot learns to better avoid the icing threat, or he/she falls down that ice-slickened slope and ventures even further into hazard's realm.

Of course, sometimes something bad *does* happen, either on a pilot's first icing encounter or after that pilot has developed an unfounded level of comfort with ice. Observe the limitations, and heed the advice of Steve Green's article linked in last week's report.

Thank you, Robert.

See https://www.mastery-flight-training.com/20201022-flying-lessons.pdf

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

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https://www.paypal.com/donate/?token=E78wOSz-a-lWNuNMxHjQRZ4awYMDr8zvX2iJxHs_Cv-b7_6nFbhuIMAIJTU-lkBDsW160G&country.x=US&locale.x=US

Fatal accident rates fluctuate

AOPA has published the 2017 and 2018 *Nall Reports* analyzing NTSB accident reports. AOPA delays publishing the reports until at least 80% of reported mishap reports are finalized and a Probable Cause identified, hence the delay in publication.

According to AOPA, although total accident numbers have increased, the rate (per estimated 100,000 flight hours) has decreased. Total fatal accident rates have decreased "slightly." From AOPA's announcement:

> [T]he total number of general aviation accidents in 2017 decreased from 1,227 in 2016 to 1,204. The 2017 analysis also saw an improvement on 2016's overall accident rate of 4.98 accidents per 100,000 hours, coming in at 4.81 per 100,000 hours.
>
> The 2017 fatal accident rate also dropped slightly from 0.78 per 100,000 hours the previous year to 0.76 per 100,000 hours. The 30th edition of the report, covering 2018 data, noted an increase in total accidents to 1,224. However, it found a further drop in the total accident rate to 4.56 per 100,000 hours as well as a decrease in the fatal accident rate to 0.74 per 100,000 hours.

> Continuing a longstanding trend, **personal flights made up to largest percentage of fatal non-commercial fixed-wing accidents** in both years—82.7 percent in 2017 and 80.7 percent in 2018. **Landing accidents, of which there were 335 in 2016, dropped to 314 in 2017 and rose to 322 in 2018.**
>
> **Weather-related accidents** spiked from 23 (12 fatal) in 2016 to 42 (32 fatal) in 2017. 2018 saw a decrease in weather-related crashes to 23 (21 fatal). In all three years, the majority of those accidents involved VFR flight into IMC.

More from AOPA:

> GA [general aviation] flight time is estimated using the FAA's annual General Aviation and Part 135 Activity Survey, which breaks down aircraft activity by category and class and purpose of flight, among other characteristics.

Getting an accurate account of accident rates, which may affect training emphasis, regulatory changes and insurance premiums, is why **it is so important for airplane owners to accurately respond to the FAA's survey on airplane use every year.**

Access the 29th and 30th *Joseph T. Nall Reports* (2017 and 2018 data, respectively) here. Thanks to my friends at AOPA's Air Safety Institute for continuing to provide these valuable analyses.

However, the NTSB reports that both accidents and fatal accident rates increased in 2019. In a preliminary account reported here on *AVWeb*, the NTSB states:

> …both general aviation and the airlines [saw] a slight increase in both total and fatal accidents. On-demand Part 135 operators saw a slight decline in accidents but an increase in the fatal rate.
>
> …for general aviation, while flight hours were up fractionally (21.8 million vs 21.7 in 2018), there were 55 fewer accidents (a total of 1,220) but more fatalities (406 on board, up from 376 in 2018), resulting in, predictably, **a slight drop in overall accident rate, to 5.592 per 100,000 flight hours, but an increase in the fatal rate, to 1.069 (up from 1.025)**. Overall, the fatal accident rate in GA has hovered around 1 per 100K since 2015. Flight hours had been on steady increase since dropping below 20 million a year in 2013.

The report cautions:

> While the NTSB will conduct a more in-depth analysis of the figures in the near future, the early stats reveal an industry undergoing expansion—remember, this is through 2019—and, with that, a greater number of accidents. This time next year, the results of the massive 2020 downturn will likely paint a very different picture.

Such is the nature of accident rates that have essentially plateaued for years. Sadly, **almost all accidents involve the same, predictable scenarios**—the *LESSONS* we try to learn here, and elsewhere as taught by my counterparts, so we might finally break this tragic cycle that so often mars our potentially extremely safe industry.

See:
https://www.aopa.org/training-and-safety/air-safety-institute/accident-analysis/joseph-t-nall-report
https://www.avweb.com/aviation-news/accidents-edge-up-in-2019-ntsb/?MailingID=480

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