FLYING LESSONS for September 24, 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. 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:

Plans, and Patience

From the NTSB:

On August 20, 2020, **about 2306 central daylight time**, an experimental amateur-built Lancair Super ES was destroyed near Ely, Minnesota. The pilot was fatally injured. **The airplane arrived at Ely Municipal Airport (ELO), Ely, Minnesota, about 1200**, and the pilot was given a minivan to use. The pilot returned to the airport 1600-1700 and asked airport personnel if he could continue to use the minivan. The fixed base operator at ELO closed at 1700. **The pilot was waiting for the destination weather at Grand Marai, Minnesota, which was fogged in, to clear**.

Lancair Super ES (stock image; not the accident aircraft)

Two witnesses at White Iron Beach Resort stated they had gone out to sit on the end of the dock for the evening and star gaze. When they first sat down, the sky was clear, and they could see the stars. However, **a cloud layer began to develop**, and they could not see the stars anymore. They continued to have very good lateral visibility and could see the island out in front of them from the dock. All was quiet while sitting on the dock.

Then they heard the noise of an airplane. They saw an airplane **diving down toward the water**; they could see lights from the airplane and its silhouette. The airplane then **climbed up and disappeared into the clouds**. The airplane **then came back down through the clouds** and was aimed right at them on the dock. The airplane noise had been loud the entire time. They thought the airplane was going to hit the water in front of the dock, but one wing was lower than the other, and **the airplane pulled up** just in front of them, **turned left and climbed back into the clouds**, disappearing from their view **in a steep, straight-up climb**. Seconds later, **the airplane came down in a straight down nosedive** followed by a "boom" and immediate silence. They immediately called 911 at 2306. From the first time they heard and saw the first dive, to the third impact dive, **less than three minutes had passed**. The airplane **noise was loud** through the entire time they had witnessed the airplane with **no popping or sputtering**.

The airplane impacted White Iron Lake **about 5.5 nautical miles northeast of the ELO**.

At **1945**, the National Weather Service (NWS) Aviation Weather Center issued an Airmen's Meteorological Information (**AIRMET**) SIERRA advisory **for instrument flight rule (IFR) conditions** in mist and fog, ceilings below 1000 ft, visibility below 3 statute miles due to mist/fog, for an area that included the accident location. **This AIRMET was valid at the accident time**.

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The **ELO Automated Weather Observing System** recorded at 1135 [PM, 24 minutes after the crash]: **visibility - 10 statute miles, ceiling - broken at 700 ft AGL, temperature and dewpoint both 16 degrees Celsius. Dark night conditions prevailed** at the time of the accident.

The pilot held a private pilot certificate The pilot received instrument airplane instruction in preparation for an instrument airplane examination that he planned to undertake in the Fall of 2020.

See https://app.ntsb.gov/pdfgenerator/ReportGeneratorFile.ashx?EventID=20200821X35853&AKey=1&RType=Prelim&IType=LA

The pilot had had a long day. The NTSB preliminary report does not say where the airplane was before arriving at Ely around noon, but a Flightaware track shows the airplane departed South St. Paul, Minnesota at about 10:30 that morning and flew an hour and 40 minutes to Ely. South St. Paul is near the registered address of the speedy homebuilt.

See https://flightaware.com/live/flight/N997S

It's not clear whether he had business at Ely or if he was waiting out the weather between there and Grand Marai—on Lake Superior (the largest freshwater lake in the world) on Minnesota's north shore—through the afternoon. We don't know if the pilot slept during that time, but when was the last time you got quality sleep in the middle of the day during a weather delay? But by the end of the day, when the pilot was expected to return the courtesy van to the FBO, conditions did not permit the pilot to fly visually to his destination and he arranged to keep the van after business hours.

We don't know what pressures the pilot may have been under to get to the Lake Superior shore that evening. **We *do* know** that at about 11 pm—twelve and a half hours after taking off that morning, and 11 hours after arriving at Ely—the pilot took off again into dark-night, known instrument meteorological conditions (IMC). He only made it five miles from the departure airport; the last three minutes of his life was in a barely controlled rollercoaster ride, with massive up- and down excursions before running out of altitude and options in the dark night.

Being awake for 17 to 19 hours roughly equates to a blood alcohol content of .05, according to a study by Dr. Ann Williamson of the University of New South Wales, Australia. If the pilot awoke at 6 am that morning and had not slept since, he was at this level of fatigue exposure when the airplane took off.

See https://www.ishn.com/articles/84638-fatigue-vs-alcohol-effects-can-be-similar

Witnesses describe a flight path consistent with spatial disorientation and the spiral tendency of a pitch-stable airplane—what I've previously described as **Killer Stability**. A pitch-stable airplane is one that, once trimmed, will tend to maintain a constant airspeed...more correctly, a constant angle of attack (AoA). If something upsets the equilibrium, such as turbulence or a change in vertical wind speed, or if the pilot adds or reduces power, adds or decreases drag, or increases or decreases G load, then the airplane will pitch up or down as necessary to try to return to the trimmed airspeed/AoA.

See https://www.mastery-flight-training.com/20190214-flying-lessons.pdf

If the wings are banked in a *steep* turn, once the bank angle exceeds about 35°to 40°, bank will continue to increase unless you apply some opposite aileron. We call it the *overbanking tendency*. Beyond a shallow bank angle, most aircraft are neutrally stable to slightly unstable in roll—they will not recover toward wings-level on their own, and may in fact tend to bank even more.

See https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/airplane_handbook/media/11_afh_ch9.pdf

If you don't notice the overbanking tendency, or you do not properly correct for it, the aircraft will continue rolling. As the wing rolls away from the horizontal, there's less and less lift holding the airplane up. Without vertical lift, the aircraft's nose will drop below the horizon. If you're banked to the left in most propeller aircraft the effect is even more pronounced as the left-turning tendency of the propeller pulls you "downhill."

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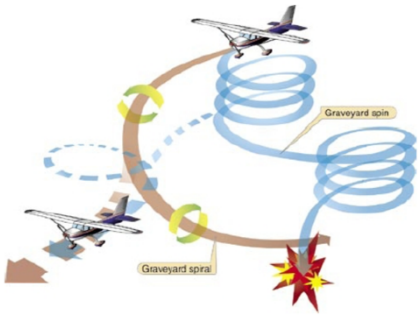
As the airplane's nose begins to point downward toward the earth the aircraft gains airspeed. Since a properly trimmed airplane will attempt to maintain a constant airspeed/AoA, it will now pitch "up"—relative to airplane, ***not*** the horizon. This "up" is pointed toward the center of the spiral. Pitching toward the center merely creates a steeper the bank angle, which reduces vertical lift more, which causes the nose to drop further, which causes even more speed, which makes the airplane pitch "up" even more...and so forth. This we sometimes call a "graveyard spiral."



All it takes for an airplane to enter a graveyard spiral is for a pilot to become disoriented and to let the wings bank more than about 30 to 40 degrees. Enter IMC without the skills to fly by reference to instruments, with those skills but with inoperative instruments or contradictory instrument indications, and/or to be impaired by illness, medication, or fatigue, and enter a steep turn…and you'll probably slide into a graveyard spiral.

Research from AOPA shows that the typical pilot under these circumstances will last about **178 seconds** before all control is lost. 178 seconds—just under three minutes.

See https://www.youtube.com/watch?v=b7t4IR-3mSo

In many accidents, the pilot attempts to retake control, rolling the airplane's wings level. This returns the aircraft's lift vector to the vertical, so it pitches up—forcefully because it is traveling so much faster than the speed for which it is trimmed. The force of pull-up can overstress the airplane. It can incapacitate the pilot. Or it can devolve into a new bank, that results in a new spiral, and so forth….

You can read more about spirals, spiral recoveries, and how spirals differ (radically) from spins in my previous **Killer Stability** *LESSONS*. But the spiral was the result, not the cause, of this mishap. What happened was that a pilot, very likely **under the influence** of extreme fatigue, attempted to take off, at night, into a low ceiling without the skills to do so.

See https://www.mastery-flight-training.com/20190214-flying-lessons.pdf

Diurnal variation is the change in temperature. During the day, solar radiation (incoming heat from the sun) exceeds terrestrial radiation (heat lost to space) and the surface becomes warmer. At night, solar radiation ceases, but terrestrial radiation continues and cools the surface. Cooling continues after sunrise until solar radiation again exceeds terrestrial radiation. Minimum temperature usually occurs after sunrise, sometimes as much as one hour after. The continued cooling after sunrise is one reason that fog sometimes forms shortly after the sun is above the horizon.

See https://www.aviationweather.ws/009_Temperature_Variations.php

However, any time the air cools to the dew point, that is, relative humidity reaches 100%, low clouds and/or fog can form. Air over or downwind from water will contain more moisture and reach the point of condensation sooner that surrounding areas.

A common pilot mistake in this era of self-briefing using online weather services is to look at METARs and TAFs, forgetting that these reports and forecasts are only valid within five miles of the reporting point. Airport weather reports may not describe what's happening between reporting points.

Regardless, if low clouds or reduced visibility prevent a flight in the afternoon or early evening, unless a frontal system passes the conditions will almost certainly only get worse until the temperature increases the next day.

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Ultimately the cause of this accident was probably nothing more than impatience. The pilot had plans, and for a while at least he displayed patience in waiting out the weather. When his patience ran out, and he chose to try regardless of the weather, the time and his likely fatigue state, he lasted about 178 seconds before beginning a cycle of spirals and recoveries that ended in a crash.

After a long day of adverse weather, it's not likely to get better after dark. All it takes is a little patience to avoid tragedy.

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

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Debrief: Readers write about recent *FLYING LESSONS:*

We'll devote next week's *LESSONS* to reader mail—we've got a lot of it.

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

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What's Worth Saving?

Save some gas money, or save your life? My friend and reader Max Trescott analyzes the crash of a Cirrus SR22 in which he makes the case that an improperly flown approach in instrument meteorological conditions (IMC) was made fatally worse because the pilot diverted to save about $90 on avgas. Listen to Max's Aviation News Talk podcast about this tragedy. Consider learning from Max and his guests every week—I'm a subscriber and supporter myself.

See:
https://aviationnewstalk.com/podcast/162-cirrus-sr22-crashes-on-an-instrument-approach-after-fuel-stop-to-save-90-ga-news/
https://aviationnewstalk.com

Prop Quiz

FLYING LESSONS reader, instructor and friend Russ Still (of Gold Seal online instruction fame) has launched a YouTube-based aviation game show called the Prop Quiz. Join Russ and an array of flight instructors and other pilots for a fun and educational contest of aeronautical knowledge. Subscribe and join the fun now.

See:
www.groundschool.com
https://www.youtube.com/channel/UC03gK7_Izx7ylFyqke1foMA/videos

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Snow? Already?

Safety Alert SA-082, "Flight in Snow," highlights the importance of assessing, understanding and preparing for the risk of wet snow and icing conditions before flight. The Safety Alert, from the U.S. National Transportation Safety Board, provides guidance to pilots, dispatchers and operators regarding flight during wet snow and icing conditions. Take a read before the snow flies.

See https://www.ntsb.gov/safety/safety-alerts/Documents/SA-082.pdf

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Thomas P. Turner, M.S. Aviation Safety
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