Taking the Boring Course of Action

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Pilots are constantly being made aware of the dangers of flying, to the point that their eyes glaze over and they just can't take in any more information. A significant amount of safety talk, however, is quite general in nature, or may not apply directly to the pilot in question or his or her airplane. A Cessna 170 pilot who flies out of an uncontrolled airport and never files a flight plan doesn't really give a hoot about the dangers of wake turbulence when flying into a Class B airport. A Bonanza pilot who always files IFR and rarely looks outside the cockpit doesn't want to spend time reading about the dangers of canyon flying. He's late for a business meeting anyway.

With that in mind, I wanted to thoroughly examine accidents of specific models of aircraft to determine the human and machine factors which relate to each aircraft. For example, while the 170 and 185 might seem very similar to the untrained observer - or even the average pilot - the types of accidents which are most common for the two planes, and the types of pilots who suffer said accidents, are often not very similar at all. My sources of data were the US NTSB and the Canadian TSB accidents reports available online to the public. While there may have been accidents in other countries I missed during my search, the vast majority are likely to be reflected in this article.

Depending on the year, the average fatal accident rate for general aviation is approximately 3 accidents for every 100,000 flying hours. This encompasses everything from corporate pilots in Gulfstream G650s (statistically a very safe mode of transportation) to student pilots in Cessna 172s (...somewhat less safe). This rate is calculated by counting the number of fatal accidents, then dividing that number by the product of the number of active aircraft on the FAA register multiplied by the average number of hours flown by the average aircraft in that fleet, as determined by the Aircraft Bluebook. This number is an overall average for the fleet over time, and may not represent current usage, but is the only available estimate for this project.

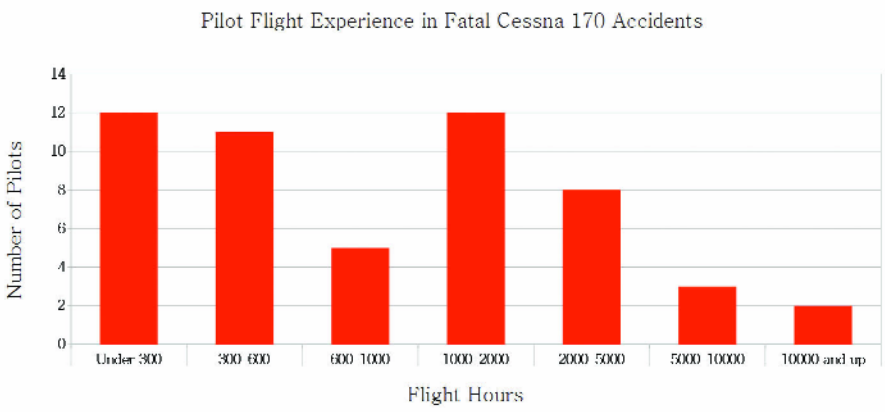
For the Cessna 170, this number is 70 hours per year - approximately one third that of the average 172, a number no doubt influenced heavily by the thousands of trainer aircraft in the world. As there are 2366 170s on the FAA register as of January 2015, it is estimated that there are 165,620 hours flown every year by this type of airplane.

Some quick mental calculations will tell you it would only take a small number of fatal accidents per year to cause a sharp rise in the fatal accident rate. Thankfully, in recent years, there have not been a whole lot of fatal accidents involving the 170. From 2000 on, the 170 fatal accident rate has been approximately 0.64 per 100,000 flight hours - slightly higher than the overall 172 average of 0.42, but much lower than that of the newer Beech Model 36 Bonanza at 1.6 per 100,000 flight hours.

What is especially telling, however, at least to those still awake after all those boring numbers, is an analysis of the types of accidents and the pilots involved in them. The accidents I reviewed occurred between 1982 and 2014, as more complete and descriptive NTSB accident reports became available in 1982.

One might assume that the vast majority of fatal aircraft accidents involved low time pilots making rookie mistakes - forgetting to put enough fuel in the plane, stalling on base-to-final, or becoming disoriented on their first night flight without an instructor. While there were certainly plenty of inexperienced pilots who unfortunately met an untimely demise as a result of a mistake on their part, there were as many pilots with between 1000 and 2000 flight hours who were at the controls during a fatal 170 accident as there were pilots with under 300 total hours.

Overall, the average fatal Cessna 170 accident pilot was 44 years old with 2026 flight hours and 265 hours in 170s. There were 32 private pilots, 12 commercial pilots, and 5 airline transport pilots involved in fatal crashes, along with 3 student or unlicensed pilots. The youngest was 20 and the oldest 80.



Stalls were the number one cause of fatal 170 accidents. That's not even including stall/spin accidents, which placed fifth - behind being drunk or under the influence of narcotics. I broke those "under the influence" accidents into separate categories, although one or two did fit into others as well - say flying into power lines, or attempting to buzz people on the ground and

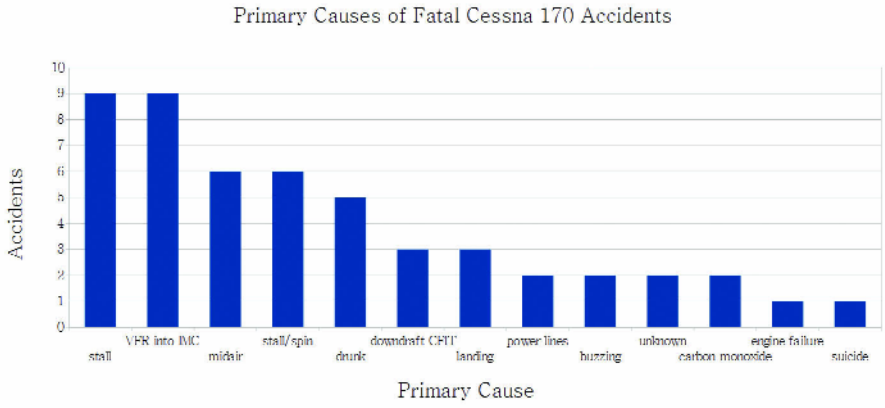
by Andrew Tuohy

impacting the ground instead. As an aside, drunk/illicit drug impaired pilots in 170s accounted for more fatal accidents than drunk or otherwise impaired pilots in 180s and 185s combined. I simply cannot fathom trying to fly while drunk, but then again, I don't understand drinking and driving, either.

Statistically speaking, stalls and stall/spins in the Cessna 170 accounted for a much greater percentage of fatal accidents than the 172, 180, 182, or 185. Thirty-one percent of fatal 170 accidents occurring after the year 2000 were the direct result of stalls (including stall/spins). Twelve percent were the result of stall/spins. These numbers hold back to 1962, when NTSB records began - thirty percent are the result of all stalls, and fourteen percent the result of stall/spins. For the other Cessna singles studied, the stall and spin numbers are approximately fifteen and three percent, respectively, with the exception of the 120/140, accident rates which were comparable to the 170.

Puzzled by the discrepancy, I contacted Harry Clements, an aeronautical engineer who started at Cessna in 1951 and worked on the 180 and 310 as well as being the principal designer of the 170C - a never-produced aircraft which, with the addition of a nosewheel, would become the 172. I asked him if there was anything inherent to the 170 which would make it more spin-prone than the 180 - or if spin recovery would be more difficult in the 170. I was most interested in the difference in empennage and tail feather design between the 170 and the 180, but as it turned out, the answer was somewhat different.

Mr. Clements said, "Let me start by saying that we felt the spin characteristics of both airplanes were OK so (that) was not a problem we spent any time on. But the main differences between the airplanes is both what we did spend time on and would have had an effect on general spin characteristics - the c.g. range on the 180, which, because what we did to improve the performance of the 180 (over the 170) was mostly in front of the firewall: bigger engine, constant speed prop, and cowl flaps. The c.g. range on the 180 was forward of that on the 170, which gave us problems with 3-point capability on the 180, and led to the use of the adjustable stabilizer on it. I think it was the only Cessna airplane with that feature, and it was not needed on the tri-gear 182.



But the generally accepted conclusion is that a forward c.g., like on the 180, made it harder to enter a spin and easier to recover from it - so spin characteristics of the 180 should have been better than on the 170 just because of that.

But, we put the large and square empennage on the 180 because of the c.g. range and power effects from the larger, more effective power arrangement. So the larger and more efficient empennage on the 180 would also have enhanced its spin recovery characteristics."

Statistically speaking, stalls and stall/spins in the Cessna 170 accounted for a much greater percentage of fatal accidents than the 172, 180, 182, or 185.

Mr. Clements suggested that I look more closely at the pilots involved in 170 accidents, which is what prompted most of this article. The pilots involved in fatal stall and stall/spin accidents were about evenly split between low-time - or low 170 time - pilots and pilots with what most would consider significant experience. On the surface, a stall/spin accident is a stall/spin accident - a failure to manage airspeed, altitude, bank angle, airplane coordination, or all of the above ("failure" is the NTSB's favorite word, and "failure of the pilot" its' favorite phrase).

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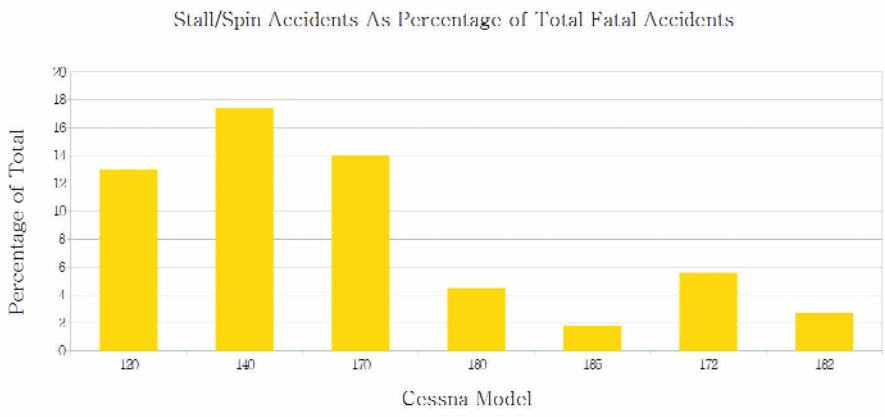

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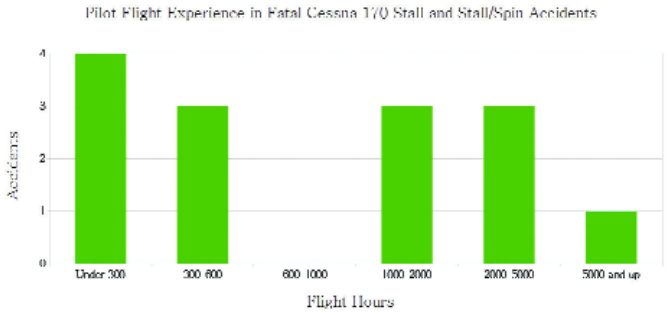
Delving deeper, however, I found some differences. The experienced pilots, for the most part, knowingly put themselves in dangerous situations. Few would say that a pilot with 1500 hours, 1460 of them in 170s, did not know the flight characteristics of the 170 - and yet a commercial pilot with just those qualifications died after a stall/spin while spotting cattle at low altitude. On the other hand, a low time pilot was more likely to load up a 170 with four people and try some extreme maneuvers to make it in to a small strip, banking too hard while too slow on the way in and ending up spinning into the ground. One pilot knew what he was doing and the other didn't, but both are equally dead.

Though far less common in the past decade and a half, VFR into IMC was a leading cause of fatal 170 crashes since 1982. Many of these pilots had instrument ratings and thousands of flight hours, but quite a few had almost no experience whatsoever. It should not be forgotten that safe instrument flight does not start at 400' AGL in a mountain pass while out of contact with an air traffic control center.

Midair collisions were a major factor. While this may change with the upcoming ADS-B requirements, nothing is a substitute for looking outside the airplane for traffic, especially when near airports. Only one midair collision involving a 170 was not (according to the NTSB) at least partially the fault of the 170 pilot: a low-time, 20-year-old pilot who was essentially rear-ended by a faster Cessna 210. The engine of the 170 separated from the airframe in the collision, but the 282-hour 170 pilot managed an emergency landing which resulted in his survival. Kudos to him. The 210 pilot, unfortunately, did not survive.



We do know, however, how many lives have been lost from the wrong course of action: too many.

Accidents relating to mechanical failure were quite rare. There was only one which could be attributed to engine failure and two to carbon monoxide incapacitation. This is likely a reflection of the general reliability and safety of a properly maintained Cessna 170.

What I defined as "downdraft CFIT" could be expanded into "a pilot attempting to exceed the climb capabilities of the airplane while flying close to terrain." For the most part, lesser experienced pilots were at the controls of these airplanes. These accidents involved 170s equipped with the Continental C-145 or O-300 as well as those equipped with the Lycoming O-360. There were also stall accidents with O-360-equipped 170s.

While the added power and performance of the Lycoming undeniably provides better rates of climb and cruise speeds, it should not be counted on as a magic wand to get you out of a tight spot. If you couldn't make it over that ridge with the original O-300, do you really want to bet your life on an additional 35 horsepower (much less at altitude)?

Of course, everything seems clear in hindsight, when I'm sipping a tasty beverage while reading NTSB reports. What seems obvious to me might have been lost in a cloud of other thoughts to the accident pilot, and it goes without saying that they are no longer around to defend themselves and their thought processes. But the most telling statistic was what I, for the most part, didn't find: pilots who avoided unnecessary risks.

There aren't any NTSB reports on pilots who landed halfway between their departure and destination airports to wait out bad weather, or pilots who gave themselves an additional few hundred feet when conducting slow flight spotting operations, or pilots who didn't try to show off maneuvers better suited to Patty Wagstaff in an Extra 300.

We don't know how many lives have been saved by taking the more boring course of action. We do know, however, how many lives have been lost from the wrong course of action: too many.