THE KILLING ZONE

AIRPLANE ACCIDENTS AND LESSONS FOR SURVIVAL

THIRD EDITION

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The Killing Zone: Airplane Accidents and Lessons for Survival
Third edition
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None of the material in this book supersedes any operational documents or procedures issued by the Federal Aviation Administration, aircraft and avionics manufacturers, flight schools, or the operators of aircraft.

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Contents

CHAPTER 2

PILOT PROFILES

Throughout this book, we will examine airplane accidents and the circumstances that led up to those accidents. As you read each accident case, it is important that you try to see yourself in the same situation as the pilot in the accident. If, when learning about an accident, you instead say to yourself, "I would never have done that!" or ask, "What was that pilot thinking?" or tell yourself, "I would never place myself in that situation," then you rob yourself of truly understanding what happened and what motivated the pilot. Remember that pilots make decisions under all types of pressure, and when you encounter those pressures, they might change what you would normally do. While sitting on the couch reading about an accident, it is easy to separate what you think you would do from what the pilot did in the real pressure-packed situation. Completely separating yourself from the accident pilot and insisting that you would have done things differently, can lead to an attitude of invulnerability.

The FAA has identified five hazardous attitudes within pilots as outlined in its Advisory Circular 60-22, *Aeronautical Decision Making*.[1] One of those attitudes is the belief that an accident just cannot happen to you—because you are invulnerable. With an attitude of invulnerability, you may acknowledge that accidents do happen, but they only happen to other pilots who are not as sharp as you, or not as prepared as you. You feel bad for those other pilots because they are susceptible to accidents, but that is not you. You are bulletproof. If we learn anything from the study of airplane

1. Federal Aviation Administration, *Advisory Circular* 60-22, "Aeronautical Decision Making," AFS-800 (Dec. 13, 1991), https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/22624.

accidents, it must be that we are not invulnerable. From reading over 12,000 accident reports between 2012 to 2023 and tabulating the data, I counted 8,854 airplane accidents where the pilot and passengers survived the accident with only minor or no injury. Therefore, it is inevitable that many of those 8,854 accident survivors are reading this book now. Those pilots will tell you that, in fact, an accident can happen to any pilot. All pilots are vulnerable. Being in an accident does not mean that you were a bad pilot. On the contrary, pilots who have been in an accident and pilots who have not are all held to the same standard for training and proficiency.

So, as we learn about the circumstances surrounding an airplane accident, conduct this exercise: For just a moment, stand in the accident pilot's shoes before the accident. Put on their headset and understand that someday you could find yourself in the exact same situation. Entertain the idea that given the same pressures of a situation, you might also make the same decisions that the accident pilot made. Please do not blow this off by saying, "Yeah, this is important information, but it could never happen to me." By understanding that it can happen to you, you will be more on your guard. You will be able to spot the signs early. You will do all you can to avoid becoming a number on an accident report. By checking your hazardous attitude as you read through this book, you can become a better, safer pilot.

A profile is a description of a person. In the following profiles, the people described are pilots, so if you are a pilot, then in a way, I am describing you. Stand in the pilot's shoes—because they are your shoes as well.

Student Pilots

In 2016, the rules for student pilots changed a great deal. The Student Pilot Certificate is now obtained by applying directly to the FAA—not at the doctor's office. But an FAA medical certificate is still needed, at least one time for those pursuing a Private Pilot Certificate. Sport pilots are only required to have a driver's license in lieu of FAA medical, even at the student pilot level, as long as they have never had an FAA medical denied or revoked. Student Pilot Certificates issued after this rule do not have an expiration date, but it is expected that the student will surrender their student certificate when they pass a practical test for a higher pilot certificate (Recreational, Sport, or Private) whenever that takes place. The FAA medical certificate still has three levels: first, second, and third class. At least a Third Class Medical Certificate is needed to fly an airplane solo, and that certificate does have an expiration date. The Third Class Certificate is valid for 24 calendar months if the pilot is older than age 40 or 60 calendar months if the pilot is younger than age 40. After the Third Class Medical Certificate expires, the pilot could continue flying under the BasicMed provisions, with certain restrictions. BasicMed requires the holder to have a regular driver's license, get a physical from a state-licensed physician, and take an online course.

Student pilots remain a relatively safe category of flying. It is always presumed that this is true because student pilots are supposedly under the watchful eye of a flight instructor. Flight instructors legally hold veto power over student pilots. FAA regulation 14 CFR §61.87 states, "A student pilot may not operate an aircraft in solo flight unless that student has met the requirements of this section." This section requires that a flight instructor teach pilot skills, provide aeronautical knowledge, determine if the student pilot is proficient, and provide an endorsement that allows the student to fly solo. No endorsement means no solo (at least no legal solo). This flight instructor's approval is required for the student pilot to fly around the local traffic pattern or to fly solo to distant airports. Good flight instructors usually allow the student to gather their own facts about an impending flight and formulate their own go/no-go decision. However, it is the flight instructor who gives the final go-ahead with an endorsement that allows a solo flight or a denial that cancels the flight.

In the ten years of airplane accident data from 2012 to 2021, my tabulation found 661 accidents involving student pilots flying solo. Of these accidents, 41 were fatal. Fatal accidents were 6.2 percent of the total student pilot solo accidents. Compare that with private pilots whose fatal accidents were 14.3 percent of their total. Student pilot accidents were far less lethal. The majority of student pilot accidents took place during takeoff or landing. The probable cause most often cited by the NTSB for student pilot solo accidents was a hard landing or "abnormal contact with the runway." Learning to land an airplane takes patience and practice. Depth perception, control of airspeed, determining distances, flight control coordination, and finesse are all needed to bring an airplane back to the ground safely. At first it seems impossible to get all those moving parts lined up. But with patience and practice, it will come together. Wilbur Wright said about learning to fly that "if you really wish to *learn*, you must *mount* a *machine* and become acquainted *with its tricks* by *actual trial*."[2] Wilbur Wright knew that to fly an airplane, it takes skills, and those skills must be learned and practiced. I think if Wilbur Wright tells us something, we should listen. But sometimes the practice comes with a hard landing or two.

NTSB Number GAA15CA016. Mount Vernon, Ohio.[3]

In 2015, a solo student pilot was on a local flight to practice touch-and-go landings. During the second landing attempt, the airplane touched down hard on the runway and bounced. The airplane bounced again before the pilot initiated a go-around. As the pilot added power, the airplane descended nose first into the runway. The student pilot was unhurt, but the airplane sustained substantial damage to the firewall and fuselage. This accident was typical. The student just did not handle the flare and

2. Omega G. East, *Wright Brothers*, Historical Handbook Series No. 34 (National Park Service, 1961), 9.
3. "Aviation Investigation Final Report, Accident No. GAA15CA016," National Transportation Safety Board, June 1, 2015, https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/90916/pdf; "Project Summary: Aviation Investigation—6 Docket Items—GAA15CA016," NTSB, May 20, 2015, https://data.ntsb.gov/Docket?ProjectID=90916.

touchdown smoothly and hit hard enough on the runway for the airplane to bounce. Once back in the air, the go-around procedure was not started fast enough. Flare and touchdown requires a delicate touch, and the "feel for the runway" is a skill that is not automatic, but can be learned with practice.

NTSB Number CEN20CA359. Corsicana, Texas.[4]

In 2020, another solo student pilot was practicing soft-field takeoff procedures, but during the takeoff roll, the pilot lost control of the airplane and the tail of the airplane hit the ground. The stall warning horn sounded, and the pilot reported that he was overwhelmed by the situation. He was unable to regain control of the airplane as it departed the left side of the runway. The pilot aborted the takeoff; however, the airplane's right wing collided with an airport sign, resulting in substantial damage to the right wing. The student was not injured. The probable cause of the accident was that the student pilot did not maintain control of the airplane during the takeoff roll.

NTSB Number CEN13FA045. Gothenburg, Nebraska.[5]

A student pilot suffered a fatal injury while attempting to land. The student was flying solo and conducting touch-and-go landings in the local traffic pattern with other pilots in the pattern. The student pilot was approaching for a fourth landing when the accident occurred; the airplane came to rest inverted short of the runway threshold (Figure 2-1).

FIGURE 2–1.
Airplane at accident site. (*National Transportation Safety Board*)

4. "Project Summary: Aviation Investigation—2 Docket Items—CEN20CA359," National Transportation Safety Board, December 22, 2020, https://data.ntsb.gov/Docket?ProjectID=101850.
5. "Project Summary: Aviation Investigation—18 Docket Items— CEN13FA045," National Transportation Safety Board, November 13, 2012, https://data.ntsb.gov/Docket?ProjectID=85507.

A post-accident examination of the airframe and engine did not reveal any evidence of a preimpact failure or malfunction that would have precluded normal operation. The damage to the nose of the airplane is consistent with a high-impact angle of about 45 degrees. The high-impact angle and lack of significant ground travel after impact is consistent with a loss of control caused by an inadvertent aerodynamic stall. The NTSB probable cause was the student pilot's failure to maintain adequate airspeed on final approach, which resulted in an inadvertent aerodynamic stall and subsequent impact with terrain. It is not known why the student allowed the airspeed on final approach to get so slow. Maybe there was a distraction, but this story reminds us that airspeed control must be a pilot's number one concern.

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These three student pilot accidents took place under the supervision of, and with legal endorsements from, their flight instructors. But not all student pilots follow their instructor's instructions. Student pilots can never carry a passenger: 14 CFR §61.89 (a) says that "A student pilot may not act as pilot in command of an aircraft: that is carrying a passenger. . . ." A student pilot can only fly an airplane under two circumstances. They can fly an airplane when their flight instructor is in the airplane with them, and they can fly alone in the airplane with the proper flight instructor endorsement. A student pilot can never fly as pilot-in-command with someone who is not a flight instructor. But despite this regulation, some student pilots have taken passengers along anyway. From the ten years of accident data used in this study, there were five accidents in which a student pilot was illegally carrying a passenger. The reason that student pilots are prohibited from carrying other people is that student pilots are not ready to assume the responsibility for the lives of other people. The greatest privilege that a pilot can earn is the ability to carry passengers. That privilege is granted only after the student pilot passes a practical exam (checkride) for the Recreational, Sport, or Private Pilot Certificate. Pilot examiners often ask themselves before passing a student pilot and giving them the privilege of carrying passengers, "Would I let my family fly with this pilot?" If the answer is no, they do not pass the test. Four of the five accidents where students were carrying a passenger were fatal accidents.

NTSB Number CEN19FA307. Lakeview, South Dakota.[6]

A student pilot was conducting a low-level aerial observation flight with his son to determine the level of water in towers on farms nearby. After the father and son did not return at the expected time, concerned family members contacted law enforcement officers who located the wreckage the next day about 825 feet from the

6. "Project Summary: Aviation Investigation—21 Docket Items—CEN19FA307," National Transportation Safety Board, October 21, 2019, https://data.ntsb.gov/Docket?ProjectID=100213.

approach end of the pilot's airstrip (Figure 2-2). The impact damage was consistent with a loss of control in flight, followed by the exceedance of the airplane's critical angle of attack and an aerodynamic stall. The reason for the loss of control in flight could not be determined. The student pilot was taught to fly by his grandfather. It is possible the student pilot was teaching his son to fly when this accident occurred. The NTSB report mentions 14 CFR §61.89: "The pilot held a student pilot certificate and therefore was prohibited by regulation from carrying a passenger." Investigators also learned that the student pilot's endorsement from a flight instructor for solo flight had expired and that the endorsement did not cover the accident airplane's make and model.

FIGURE 2–2.
View of the airplane looking to the south. The student pilot's private airstrip is located in the upper right corner of the photograph near the trees. (*National Transportation Safety Board*)

The NTSB determined the probable causes of this accident to be: "The student pilot's failure to maintain control of the airplane, which resulted in the exceedance of the airplane's critical angle-of-attack, an aerodynamic stall, and subsequent impact with terrain, and the student pilot's non-compliance and lack of experience." The NTSB specifically cited the student pilot's non-compliance with the regulation as a factor in the fatal accident. We cannot know how many other times student pilots took passengers along when an accident did not occur or was not reported.

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The Student Pilot Certificate is, by design, for people in training to become pilots with higher levels of certification. The student certificate is intended to temporarily cover the gap between first flight and passing a pilot practical exam for Recreational, Sport, or Private Pilot Certificates. But the student certificate now has no expiration date, so what about student pilots who never decide to go for higher pilot certification? Can a person become a *career* student pilot? In addition to having a Student Pilot Certificate and medical certificate (or BasicMed), the student must have an endorsement from a flight instructor to fly solo locally or on cross-country flights. In the previous accident example, the student pilot had an instructor endorsement, but it had expired and his solo flight, with or without a passenger, was not legal. The flight instructor was likely unaware that his former student was not complying with the regulations; otherwise, the instructor would have stepped in to stop that practice.

On the other hand, career student pilots may get a flight instructor to endorse them for solo flight every 90 days, but if the instructor is enabling the student to continue as a career student, instead of improving to a higher certificate level, that is an abuse of the Flight Instructor Certificate. By dodging the intent of the student pilot regulations, these pilots never have to worry about passing a knowledge test or taking a checkride. They just fly. I think we can agree that an instructor who makes these repeated endorsements, thus enabling the pilot to get around the intent of the regulation, is doing the student and aviation a disservice. An instructor's job is to help pilots get better, not to help them through a regulatory loophole.

NTSB Number CEN18FA204. Midland, Texas.[7]

In 2018, two corporate pilots were standing on an airplane parking ramp outside of a fixed-base operator and saw an accident. The corporate pilots saw the airplane take off and climb to about 200 feet at a slow airspeed and then stall. The right wing dropped, and the airplane descended in a right turn until impacting the terrain. A post-impact fire occurred (Figure 2-3). The pilot of the airplane was a student pilot with 192 total flight hours. The number of 192 flight hours far exceeds the minimums for the

7. "Project Summary: Aviation Investigation—13 Docket Items—CEN18FA204," National Transportation Safety Board, August 12, 2019, https://data.ntsb.gov/Docket?ProjectID=97374.

Recreational, Sport, or Private Pilot Certificates; nevertheless, this pilot was still a student pilot. There also was a passenger on board the airplane. Both the student pilot and passenger were killed in the accident.

FIGURE 2–3.
Front view of the airplane at the accident site. (*National Transportation Safety Board*)

The pilot's most recent medical certificate had expired. According to the pilot's wife, the pilot had a horse-training business and regularly flew the accident airplane between training sites, often with passengers. Another regulation, 14 CFR §61.89(a)(4), prohibits student pilots from acting as pilot-in-command of an aircraft in the *furtherance of a business*, which the wife seemed to admit her husband was doing. The pilot's former flight instructor stated that he had not flown with the student pilot in several years and that he had never flown with the student pilot in the make and model of the accident airplane.

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In the ten-year span of accidents for this research, my tabulation shows that student pilots involved in accidents had 236, 365, 400, 455, 500, 581, 750, 811, and even 905 hours of flight time. Why were these people still student pilots? Many of these student pilots were flying airplanes that they owned. This brings up a very important point. Just because you own an airplane does not mean that you can fly that airplane. This concept is unusual. If I buy a big-screen television today, I fully expect to hook it up and be watching that TV tonight. But airplanes are not like that. Students flying an airplane, of any ownership, still need to be under the training and supervision of a flight instructor and fly only with the proper flight instructor endorsements. When a student removes themself from that training and supervision, bad things can happen.

From 2012 to 2021, there was an annual average of 160,797 active student pilots in the United States, according to the BTS.[8] In those same years, there were 661 student pilot accidents. That is one accident for every 243 student pilots. There was an annual average of 166,001 private pilots in that same time period. Private pilots with fewer than 1,000 flight hours had 3,588 accidents. That is one accident for every 46 private pilots. That is a raw numbers comparison, but the accident numbers are real. Student pilots have fewer accidents than private pilots. That seems backward. Private pilots, who have more experience and who have been tested by the FAA, have more accidents than less experienced student pilots who have yet to be tested. I believe that the flight instructor oversight is making this difference.

Private Pilots

In the years from 2012 to 2021, private pilots with 1,000 or fewer flight hours were involved in 3,588 accidents, and of those, 514 were fatal accidents. Fatal accidents made up 14.3 percent of the total. Looking back at Figures 1-3 and 1-4, we see an increase in the fatal and non-fatal accident rates after a pilot passes the 50 flight hour mark. The Private Pilot Certificate requires a minimum of 35 flight hours at 14 CFR Part 141 flight schools or 40 hours for training conducted under Part 61. But the average flight time that a person has when passing the private pilot checkride is closer to 65 hours. The Sport Pilot Certificate requires 20 hours of flight experience, and the Recreational Pilot Certificate requires 30 hours. That means there are private, sport, and recreational pilots counted in the 0 to 50 hour flight time block, and there are many student pilots in the 50 to 100 hour time block. Therefore, the jump in accident rates after 50 hours cannot all be attributed to new private, sport and recreational pilots flying for the first time without a flight instructor's supervision—but much of it is. Figure 2-4 illustrates the accidents and fatal accidents among private pilots.

8. *U.S. Active Pilots*, Transportation Indicators (October 2001), Bureau of Transportation Statistics, accessed August 18, 2025, archived in the *Transportation Indicators* series. (bts.gov)

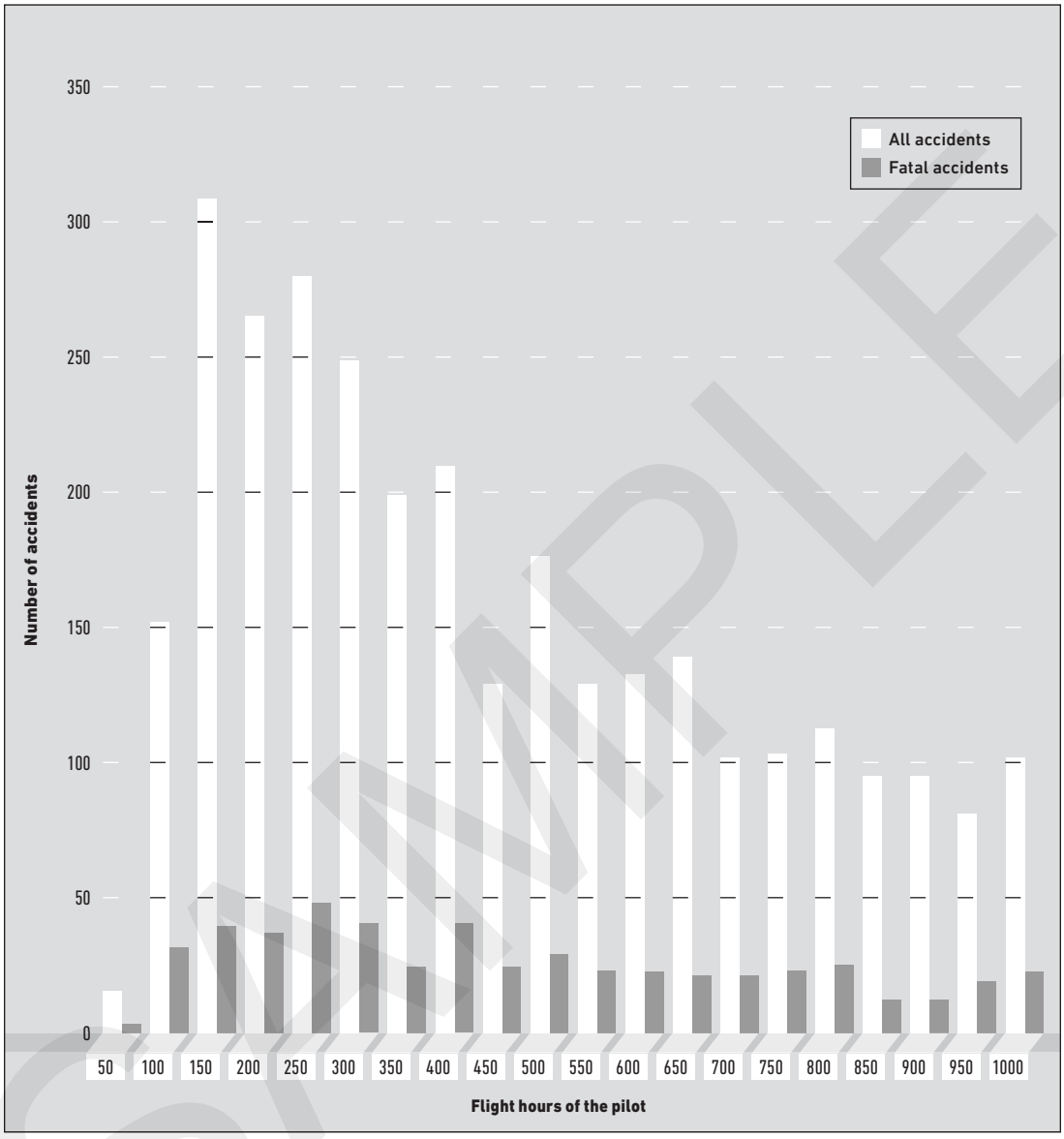

FIGURE 2–4.
Private pilot airplane accidents and fatal accidents, by pilot flight hours, 2012–2021.

The zero to 50 lines are low, but that is because so few student pilots become private pilots with less than 50 hours. As we look across the chart to the right, toward the higher flight time blocks, there would logically be fewer accidents because there are fewer private pilots at those flight time levels. Private pilots can take additional training and (under 14 CFR §61.129) can become commercial pilots after 250 flight

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The Killing Zone provides pilots with an invaluable understanding of how and why aviation accidents occur and how to improve their margin of safety while flying. Author Paul Craig leveraged his knowledge as a flight instructor and researcher to analyze National Transportation Safety Board (NTSB) accident reports with the goal of helping prevent accidents that injure or kill pilots and their passengers. His examination of 40 years of accident data found that pilots are at the greatest risk of being involved in an airplane accident when they have between 50 and 350 flight hours—what Craig calls the Killing Zone.

While previous editions of the book covered periods up through 2011, this third edition continues with an analysis of recent data from 2012 to 2023. Its expanded approach presents information on all general aviation accidents (not just fatal ones). Each chapter weaves in detailed discussions of NTSB reports to illustrate the many different accident causal factors. This edition explores new risks associated with advancements in flight deck technology and automation, increased integration of drones, and the use of artificial intelligence (AI). In contrast, advancing technologies providing GPS, pre-accident flight paths, weather radar maps, ADS-B data, surveillance photos and video, and internal aircraft data have aided aircraft investigations, which can avert future tragedies.

Whether you are a student, certificated pilot, or flight instructor, the knowledge you gain from this book will help you effectively evaluate risk and make informed decisions to increase your safety in the skies—and survive the Killing Zone.

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