

Flight Instruction Safety: An In-depth Look at Instructional Accidents



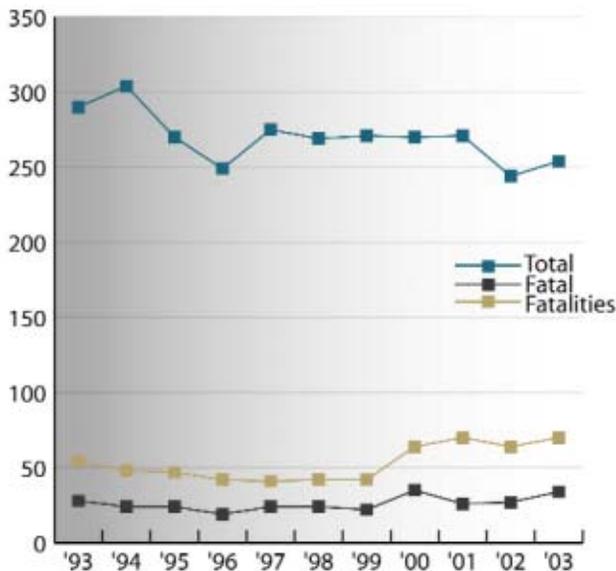
This report is based on research using the AOPA Air Safety Foundation Safety Database, the largest non-governmental compilation of general aviation accident records in the world. It is made possible by a generous grant from the Emil Buehler Trust and pilot donors like you, who believe that GA safety is to everyone's benefit. Find out how you can support ASF research and pilot education by visiting the ASF Web site at www.aopa.org/asf/development.

Flight Instruction – What's the real risk?

The good news is that your chance of having an accident while training for a pilot certificate or rating is still less than having an accident in other types of GA flying, especially personal flights by already-certificated pilots, based on the proportion of flying in each category. However, there are definitely some areas for improvement.

The bad news is that the fatality rate for GA instructional accidents has risen in recent years, from a low of eight percent in 1996 to a high of 13 percent in 2000.

Instructional Accident Trend



The AOPA Air Safety Foundation (ASF) studied more than 2,000 instructional accidents from 1992 to 2001, both dual and solo, and found some surprising facts that every flight instructor and student should know. Among other things, the study revealed that having a CFI on board is not a guarantee of safety. This study reviews problem areas for both dual and solo instructional flights and offers some suggestions for improving your safety.

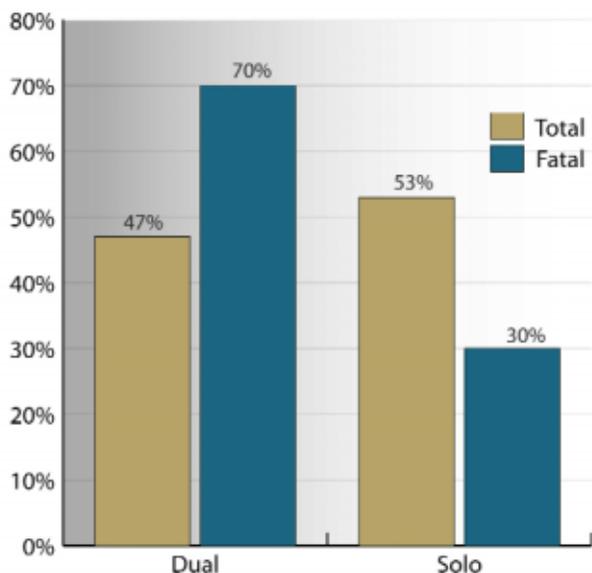
Overview

Of the 2,295 accidents included in this study, about nine percent, or 201 accidents, were fatal. Of GA accidents as a whole, about 20 percent are fatal.

That many instructional accidents in 10 years might sound alarming, but when viewed in perspective, instructional flying is significantly safer than other types of GA flying. Flight instruction comprises approximately 22 percent of all GA flying, but only accounts for 13 percent of all GA accidents, and just under six percent of all fatal GA accidents. Because of small numbers of accidents, some percentages will appear disproportionately high and should be used cautiously when drawing conclusions.

For this study, flights were considered dual if the accident report classified the flight as instructional and noted more than one pilot on board. Flights with one pilot were considered solo. The study includes **ALL** phases of flight training, not just primary instruction. Instructors were on board 1,077 (47 percent) of the flights, while 1,218 (53 percent) were solo.

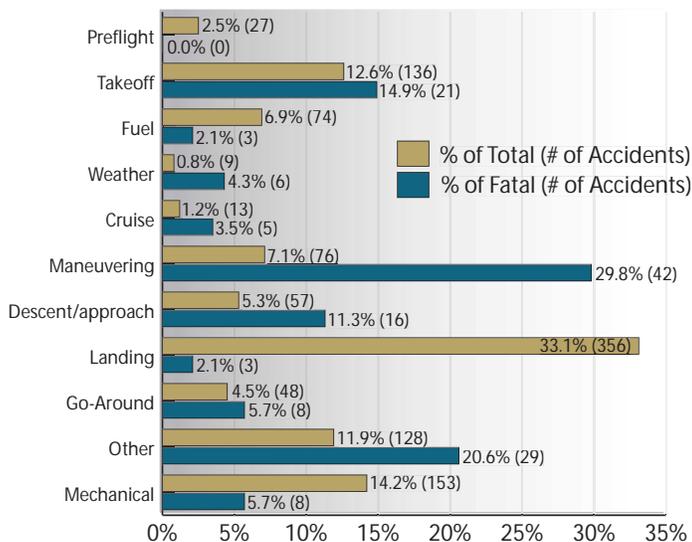
Instructional Accident Summary



Student Ups and Downs

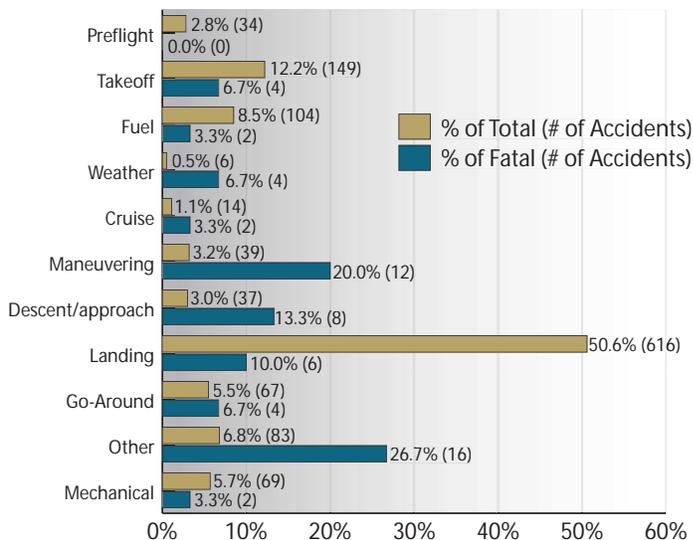
ASF found that dual instructional accidents occurred most often during takeoff and landing, accounting for a little over 45 percent of all dual instructional accidents, compared to about 58 percent for general aviation as a whole.

Dual Instructional Accident Categories



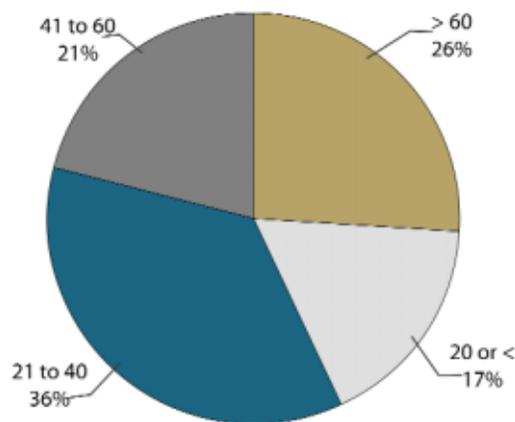
An even greater percentage of takeoff and landing accidents occur during solo practice, with nearly 51 percent of all solo accidents during landing, and another 12 percent during takeoff. As with the dual accidents, very few of these were fatal, probably due to relatively slow speeds and few obstacles close to the runways. These statistics parallel GA as a whole, where landing accidents result in fewer fatalities than takeoff accidents.

Solo Instructional Accident Categories



This study also clearly revealed the importance of supervision by CFIs, and the need for continued practice by low-time pilots. Of all solo landing accidents, 74 percent of the pilots involved had fewer than 60 total hours. Students with between 21 to 40 hours were responsible for the greatest percentage of landing accidents, at 36 percent. Considering that the average student will solo with between 10 and 20 hours of experience, and will then begin to practice without an instructor on board, this is not surprising. For more information see the Safety Advisor, *Ups and Downs of Takeoffs and Landings* (www.aopa.org/asf/publications/sa18.pdf).

Solo Takeoff and Landing Accidents Hours of Experience



Takeoff and Landing Recommendations

Take a CFI with you until you are ready to go alone in “different airport” environments. CFIs – pay attention to what the student is doing and don’t wait too long to take control if the situation warrants.

- **Fly in the wind.** Practice in windy conditions with a CFI on board – deliberately search out crosswind runways. Consider going to a nearby towered airport, if possible, to practice in the crosswind if the local non-towered airport has too much traffic on the in-to-the-wind runway.
- **Practice often.** Spend more time in the pattern, do more night landings, and practice in different kinds of weather.
- **Fly at different weights.** Load the aircraft to gross weight and see how it performs – get a “hands-on” feel of the differences between a light aircraft and a heavy one.
- **Go to a nearby field.** Practice at an airport where you haven’t “worn a groove” into the pattern.
- **Go to a short field.** The penalties for sloppy aircraft control will be immediately obvious.
- **Try grass strip landings.** The change of pace and unique environment adds zest to landings for pilots who usually land only on paved strips.

Watch Out for That Tree

Maneuvering flight, which includes low altitude practice of emergency procedures, accounted for seven percent of all dual accidents.

But maneuvering flight is one of the most deadly types of instructional accidents. ASF found that **maneuvering was the leading phase of flight in nearly one-third (30 percent) of all dual fatal accidents. A surprising 38 percent of maneuvering accidents occurred while practicing emergency procedures at low altitudes.**

The accident data suggest that CFIs sometimes fail to set safety criteria for maneuvers, or do not adhere to them. For example, when practicing an engine failure, the instructor should establish a “hard deck” (altitude) where the recovery will be made (such as 700 feet agl). With such criteria, an engine that fails to respond at the conclusion of the maneuver will not prevent a successful forced landing from being carried out, given the terrain and obstacles. The minimums required by FAR 91.119 are shown to the right, but many experienced instructors prefer a little “pad” for practicing.

The maneuvering phase of flight is most likely to result in solo fatal instructional accidents (20 percent). Of this 20 percent, half were a result of low-level flight and practicing emergency procedures. More information about maneuvering flight can be found in another ASF Safety

Advisor, *Maneuvering Flight – Hazardous to Your Health?* (www.aopa.org/asf/publications/sa20.pdf).

FAR 91.119

Location	Altitude	Horizontal Distance
Anywhere	Enough to allow an emergency landing without undue hazard to anyone or anything on the surface	
Congested-Town/open air assembly	1000 feet above highest obstruction	2000 feet
Uncongested	500 feet	Over water or sparsely populated areas - 500 feet

According to the Designated Pilot Examiner (DPE), the flight test was progressing satisfactorily when he retarded the throttle to simulate an engine out emergency. The DPE maintained control of the throttle in order to occasionally clear the engine during the descent. The applicant selected a satisfactory field, applied full flaps, and maintained airspeed of 70-75 knots.

When the aircraft was about 100 feet above the ground, the DPE called for the go-around. The applicant reached over to advance the throttle, but saw the DPE’s hand on the throttle quadrant and the throttle only half way in. The student felt the power “kick in” and proceeded to retract a “couple of notches of flaps.” At this point, the airplane began to sink at a high rate, and the student attempted to regain control and recover. According to the DPE, the student was properly executing the recovery when they impacted the terrain. After the accident, the DPE said that from the time he realized that they were going to impact the ground, to the time the aircraft came to rest, he did nothing to assist the student pilot.

The NTSB determined the cause of this accident to be inadequate supervision and the premature retraction of the flaps before a positive climb was established.

Although FAR 61.47 states that the applicant will act as pilot in command, neither the applicant nor the DPE were sure of who had control of the throttle at the time of the accident. A positive transfer of throttle control did not take place, so no one was in command of the throttle. During every flight, whether it is a personal flight with another pilot, a check-ride, or an instructional flight always identify who is PIC before takeoff and how control is to be transferred, if necessary.

Maneuvering Flight Recommendations

Before each flight, instructor and student should brief safety criteria for each maneuver being performed. If the maneuver exceeds those limits, recovery action needs to be taken immediately.

- **Transfer of control.** Establish specific transfer of control procedures on the first lesson and reinforced periodically. Verbally verify transfer: “You have the aircraft.” Response- “I have the aircraft.”
- **Altitude, altitude, altitude.** The majority of fatal stall/spin accidents occur at low altitudes, from which recovery is unlikely. Always have a predetermined safe recovery altitude for every maneuver.
- **The right way to practice.** Practice stalls or approaches to stalls at a safe altitude and only when you are competent. If it’s been a while, take an experienced CFI.
- **Altitude, again.** Fly at a safe altitude above the ground so you won’t be surprised by terrain, wires, or towers that might require a quick pull-up that increases the likelihood of a stall.
- **Formation flight, aerial photography.** These and other maneuvering activities require skill, practice and strict adherence to safe operating practices.

A student pilot and CFI were returning from the practice area in a Piper Arrow while a student and CFI aboard a Beech Travelair intended to practice traffic pattern procedures at a non-towered airport. While taxiing out for takeoff, the Travelair pilots heard a radio call from the Arrow stating that they were over flying the field and would enter the 45 for the downwind to Runway 24. The Travelair announced takeoff and upwind leg. At 700 feet AGL the Beech turned crosswind with both pilots looking for the Arrow. Before turning downwind, the instructor in the Beech radioed the Arrow for a position report, but there was no response. During the turn to downwind, the instructor aboard the Beech saw the Arrow and took control to avoid a collision. At the same time, the student aboard the Arrow did the same. The airplanes collided, but landed safely with no injuries to anyone onboard.

See and Avoid

Mid air collisions (MACs) accounted for 16 percent of dual and 20 percent of solo fatal instructional accidents.

According to ASF’s Safety Advisor *Collision Avoidance* (www.aopa.org/asf/publications/sa15.pdf), flight time is not a major risk factor when it comes to MACs, considering pilots with experience levels ranging from 12 to 37,000 hours have been involved in MAC accidents. Whether it’s inexperience or complacency, hours of uneventful flying can lead to one lapse that ends in tragedy.

Some pilots believe that having a CFI on board – providing another set of eyes - will minimize MACs. But from a collision perspective, flight training missions are among the most dangerous. **Flight instructors comprise less than 10 percent of the pilot population, yet a CFI was aboard at least one of the aircraft in more than one-third of MACs (35.5 percent).**

The reason for this statistical anomaly is not only that flight instructors often fly more than other pilots, but also that they spend much of their time operating near airports, the most hazardous environment for MACs. Also their attention is often focused on teaching rather than scanning for traffic. During instrument flight training, a hood or goggles often restrict the student’s vision, as well as the instructor’s vision to the student’s side. In addition, the instructor’s attention may be diverted by the needs of training.

MACs are most likely during peak flight training times – during day VFR conditions, between 10 am and 5 pm during the warmer months, within 5 miles of an airport, and at lower altitudes. Over one-third of the MACs studied by ASF occurred below 500 feet – final approach altitude.

Collision Avoidance Recommendations

Much can be done to prevent midair collisions. Flight schools can help reduce the risk of MACs with these measures:

- **Designate practice areas.** Each school can designate sectors in the surrounding area for flight training. Limit the number of aircraft from your school that can practice in each area at one time. If there are other schools nearby, coordinate with them.
- **Use CTAF.** Have both instructors and students use CTAF to give position reports when operating in the practice area. An example of this report could be: “Cessna 345 is in practice area Bravo, maneuvering over the quarry between three and five thousand feet.” Identify the make of aircraft so other pilots know what to look for.

- **Obtain a discrete frequency.** If your flight school is large enough or the local CTAF is frequently jammed, obtain a discrete frequency for school operations in order to reduce radio clutter. Individual instructors, whether teaching at a busy flight school or independently, are the key to both avoiding instructional MACs, and instilling the best see-and-be-seen procedures in students. Some accepted practices for avoiding MACs include:
 - **Divide your attention.** Avoid spending too much time in the cockpit. Make a conscious effort to spend more time outside than inside.
 - **Use appropriate clearing procedures.** Require students to LOOK FIRST and then verbalize “clear right” or “clear left,” both VFR and IFR, before starting a turn. Start this procedure on the very first lesson.
 - **Pick up a wing.** High wing aircraft should actually lift a wing to clear the area, since vision is completely blocked by the wing during a turn.
 - **Clear in the pattern.** On every leg of the pattern clear the next turn, especially base and final. Verbalize it- “Final’s Clear.” Don’t assume you have final all to yourself – this is a high-risk area.

The flight was the student pilot’s introductory night flight. The CFI’s preflight briefing with the student covered intended points of landing runway lengths, directions, surfaces and lighting available, forecast weather for the route, time, distance, and fuel requirements for the flight, and the need to switch fuel tanks at some point during the flight. While on the ground at an interim stop, the CFI made a mental note for the need to switch fuel tanks “probably before landing at the next airport.” Upon arrival at the next airport, the CFI verbally noted the presence of another aircraft without a landing light. According to the CFI, “this would have been a good time to switch fuel tanks.” While on final approach, the throttle was advanced from its idle setting and no engine power was noted. Examination of the fuel system revealed the left fuel tank was empty. The right fuel tank contained usable fuel.

Fuel or Fool?

Fuel mismanagement includes both fuel exhaustion and fuel starvation. Fuel exhaustion occurs when the airplane is completely out of fuel, while fuel starvation means that fuel remains, but the pilot fails to switch tanks after one runs dry. Fuel mismanagement is the primary cause in about seven

percent of all dual and eight percent of all solo instructional accidents. FAA regulations mandate minimum fuel reserves for all operations, generally 30 to 45 minutes for VFR flight. ASF recommends, however, that pilots never land with less than one hour of reserve fuel. To prevent fuel starvation, adopt and follow a routine for switching fuel tanks in flight. Many pilots will switch tanks on an hourly basis, making fuel management easy. If you’re getting into an aircraft without full tanks be careful about taking someone else’s word as to how much fuel remains. Accidents have occurred where the estimate was off by half an hour or more. Who do you think was charged with the responsibility? Not the pilot or dispatcher who told you there’s only an hour out of full tanks!

Every time you fly, follow your routine, regardless of the length of the flight. It’s good practice to use a timer as a reminder on when to switch tanks. For more information about fuel mismanagement, see ASF’s Safety Advisor, *Fuel Awareness* (www.aopa.org/asf/publications/sa16.pdf).

Fuel Management Recommendations

Of all GA accident causal factors, fuel ought to be the easiest to address, especially with an instructor on board.

- **Know how much fuel you have.** Verify how much fuel is on board before every flight. If not topped off, make sure that there is enough for your intended flight plus the required reserve. Use a dipstick calibrated for THAT PARTICULAR AIRCRAFT, if there is no physical way, such as tabs, to verify fuel load.
- **Understand your airplane’s fuel system.** Know how much fuel the engine uses, how much fuel is left in the tanks, and (particularly in twins with cross-feeding arrangements) how the fuel system and switching arrangements operate.
- **Always land with adequate reserve fuel.** The Air Safety Foundation recommends that pilots always land with at least one hour of fuel in the tanks.
- **Learn to lean.** If your power setting is less than 75 percent, engine manufacturers now recommend leaning the mixture, regardless of altitude.

Where Did that Cloud Come From?

One of the most lethal types of GA flying is attempting VFR flight into instrument meteorological conditions (IMC). Every year, too many pilots try this. Pilots on solo instructional flights aren’t exempt; seven percent of fatal solo

instructional accidents were a result of continued VFR into IMC. FAR 61.93 (e) requires primary students to receive training in flight solely by reference to instruments (hood work) prior to undertaking any solo cross-country flights. Also 61.93 (d) places accountability on the instructor to review the student's cross-country planning, the forecasted weather along the route, and to determine that the flight can be completed in VFR weather conditions.

There has not been a fatal instructional accident caused by VFR flight into instrument weather since 1995. Reasons for this could include better training of both the students and the instructors as well as the availability of better flight planning and weather forecasting tools.

The student pilot had been planning to take his long solo cross-country flight for a number of days. On the accident date the student obtained a weather briefing, which forecasted a chance of snow showers. Weather at the departure airport was light snow showers during the predeparture discussion the student had with his instructor. The student then departed on the solo cross-country flight. Approximately eight to 10 minutes after departure, the instructor called him on the radio and asked the student how the weather was. The student replied the visibility was three miles. Shortly after this conversation the student called the airport and stated he was lost and having difficulty. The airport manager, a non-pilot, told the student to make a 180-degree turn and return to the airport. A ground witness stated he heard an airplane fly overhead two times during very heavy snow showers and then a loud crash sound.

Recommendations for Avoiding VFR into IMC

With such a high fatality rate for pilots who attempt to venture VFR into IMC, it's surprising that any pilot would still want to play. Suggestions for avoiding a VFR into IMC disaster include:

- **Check forecasts, then believe what you see out your front window.** Weather forecasts have improved immensely in recent years, in part because of additional technology, but also because pilots have been submitting pilot reports (PIREPs) that can validate or invalidate weather models. The free ASF interactive online course SkySpotter® (www.aopa.org/asf/skyspotter/) offers invaluable knowledge of evaluating and reporting weather. As old pilots say, however, the only forecast you can depend upon 100 percent is the one you see out your front window.
- **Bold pilots aren't old pilots.** Continuing into deteriorating weather conditions is a sure-fire recipe for trouble. In many VFR into IMC accidents, pilots flew for many miles knowing they were just getting themselves deeper in trouble – but continued. Turn around, or land early.
- **Learn how to make a lifesaving 180-degree turn.** Many pilots don't realize they can escape from an inadvertent cloud entry by simply establishing a standard 3-degree per second turn (a standard-rate turn) and counting 60 seconds. At the end of that minute, they'll be headed out of the cloud.
- **Get an instrument rating.** In addition to earning the right to fly legally in instrument weather conditions, you'll gain additional insight into the "whys" and "hows" of the ATC system that will make you a better VFR pilot.

In Summary

There is risk involved in all types of flying, instructional included. The areas of operation pointed out in this study are not inherently unsafe, but more effort needs to be applied to reduce the number of accidents that occur in both instructional flying and GA as a whole. We hope this study has provided you some effective tools to be a safer pilot.



Safe Pilots. Safe Skies.

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