Learning to Fly

by Philip Greenspun, CFI, CFII

In getting a single-engine private pilot's certificate, you have to pick three things:

1. the plane
2. the instructor
3. the pace

Picking the plane depends to some extent on what you want to do after you get your license. If you want to rent airplanes all over the world, a Cessna 172 is a good training choice. If you want to transition to soaring, the Diamond Katana DA20-A1 makes sense because (a) the manufacturer also makes gliders, and (b) the Katana is controlled with a stick rather than a yoke, making it more like a typical glider.

Worried about safety? Statistics show that the Cessna 172 and the Diamond Katana are about the safest trainers. The Cessna 150/152 and the Piper Tomahawk have combined with student pilots to assemble comparatively poor safety records.

How about noise? The Katana isn't any bigger than it needs to be, which means that it can cruise at 104 knots with an 80-horsepower engine. The Cessna 152 needs 110 hp and the Cessna 172 needs 160 hp to cruise just a bit faster. Less horsepower means less noise. The Katana is one of the only single-engine airplanes in which I find the noise tolerable without noise-cancelling headphones.

Visibility through the Katana's plastic canopy is much better than older-design airplanes with their windshields, support bars, metal roofs, etc.

You'll never get killed in a Katana by a 25-year-old part that finally wears out; the airplanes have only been produced since the mid-1990s.

The main drawback to a Katana is space. At 6' tall and 195 lbs., I just barely fit into the machine. If my instructor were as fat as I am, we'd have to dump some fuel in order to get off the ground. If I wanted to bring the dog along on a flight, there isn't a back seat in which he could safely ride.

Finally there is an emotional element. If the old Cessnas and Pipers at most schools remind you of Volkswagen Beetles with wings, it isn't an accident. They were designed at around the same time as the old VW! The Katana looks more like the modern kit planes that your cousin might have built in his garage, but finished to a vastly higher standard.

(If you believe in the wisdom of government, you can follow the example of the United States Air Force. After an extensive evaluation of trainers, the USAF Academy decided to use the latest Continental-powered DA20s for all of their primary flight training. The US Naval Academy also uses the DA20.)

Choosing an Instructor

Most people working as flight instructors are folks anxious to get their Air Transport Pilot (ATP) certificates but not anxious to pay for 1,500 hours of airplane rental. Such an instructor may not necessarily have a great love of teaching, and if you can't complete your training in three months or so, you might find that your instructor has moved on to a job at the local commuter airline. In theory it should be much better to find an instructor who has 3,000+ hours and is teaching because he or she likes to teach. However, someone who has been an expert pilot for decades may not be able to understand what you're doing wrong or explain step-by-step how to do maneuvers. The expert pilot has deep knowledge in his or her bones and muscles. That is tough to transfer. By contrast, you might learn more from an articulate newer pilot than an older expert who is able to show, but not explain, how it is done.

The only way to evaluate an instructor is to ride with him or her. If the instructor touches the controls before the final approach to land, that's bad. A good instructor should be able to talk you through every maneuver and should have the patience to let you fly the airplane badly. You should never be afraid. The instructor should take you into progressively more challenging situations so gradually that you barely feel the challenge. The instructor should try to teach only one thing at a time. As a beginner you may be doing ten things wrong at any given time. A good instructor will pick one out of the ten to talk about and tactfully ignore your other nine mistakes.

In terms of the number of hours required to get your certificate, it might be most efficient to fly with a single superb instructor. But I flew with five different people in the right seat during my first 20 hours and learned unique and valuable lessons from each one. If you're having trouble with a maneuver, fly with a different instructor and get a fresh explanation of how to do it and a fresh perspective on what you're doing wrong. If you're worried that you're going to miss something by bouncing around from instructor to instructor, pick up a Jeppesen training syllabus and organize your own learning around it.

Finally, find instructors whose company and conversation you enjoy. You're going to have some long cross-country flights and a lot of one-on-one time waiting for planes, resting between lessons, eating lunch, etc. It might as well be enjoyable time. If it means that you need five more hours to get your certificate, at least you were having fun during those five hours.

An Ideal Pace

The best pace for learning to fly is probably the same pace at which you intend to fly recreationally. Human memory requires periodic reinforcement, ideally at roughly the intervals when you're 50 percent likely to recall (or forget). Suppose that you're able to remember random facts for about one month. You go down to Arizona where more than 350 days per year have good enough weather for visual flight rules (VFR). You train every day for three weeks and get your certificate. You go back home to New England and, due to work, social commitments, and bad weather, fly just once a month. By the time you're forgetting the stuff that you've learned, you're up in an airplane with no instructor.

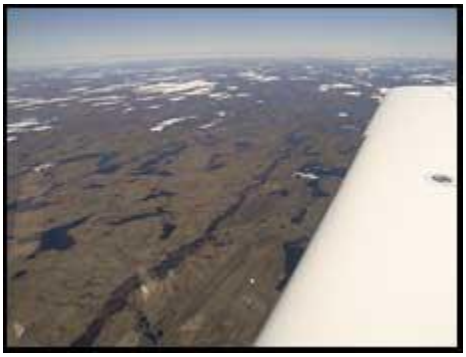
I personally opted to train three days per week and felt it was about as fast as reasonable, given the amount of reading and studying that I wanted to do in between lessons. Note that the period of time in which your probability of recall falls to 50 percent gets longer after you've been reminded a few times. Maybe you learned a VFR rule and forgot it the next day but were reminded by your instructor. It may take a week before your memory degrades to the point of 50 percent probability of correct recall. After another reminder, the next time interval might be a month. Thus it may make some sense to train intensively for a month or two and then reduce the frequency of lessons if flight training is interfering

with the rest of your life. On the other hand, once you've done all the reading and simply need to build up your coordination skills, it may make sense to fly all day every day for a few weeks.

What it Costs (time and money)

Between airplane rental, instructor time, and the various accessories that you'll want to buy, budget about $10,000 to get your private pilot certificate. If you figure that you'll get your certificate at 70 hours of flight time, budget 280 hours to build up those 70 hours. The four-to-one ratio accounts for time spent driving to the airport, waiting around for the airplane and instructor to be available, preflighting the airplane, putting the airplane away, paying your bill, and driving home. Budget another 100 hours for reading textbooks, studying rules and regulations, browsing Internet sites, talking to experienced pilots, etc. If you're a full-time wage slave, flying will be your only hobby for a while.

Tips



These are the most useful things that I've learned from my instructors.

Taxi

Prime with the electric boost pump on and watch the fuel flow. Now you know that the boost pump works. Taxi with the boost pump off. Now you know that the engine-driven fuel pump works. If it is called for in your airplane's P.O.H. ("**p**ilot's **o**perating **h**andbook"), remember to switch the boost pump back on for takeoff so that you have redundancy.

Maintain a sterile cockpit (no chatting with anyone else in the plane) when taxiing, at least if you're anywhere near hangars and other airplanes. If you are going to hit something with your plane, it will very likely be when taxiing.

Takeoff

Add a "position ailerons for crosswind" item to your takeoff checklist. In the rush of being cleared by the tower and rolling onto the runway, it is easy to forget to look at the windsock and hold an appropriate crosswind correction.

Midair

Don't look at your instruments and adjust the flight controls, for example, to keep the altimeter steady. The instruments have a tendency to lag behind reality, and therefore if you "chase the instruments" by adjusting the flight controls, you will overcorrect and oscillate. Staring at your instruments is also a good way to get motion sickness. Use the flight controls to keep the nose of the airplane at a constant attitude relative to the horizon. After you've got that attitude established, glance at your instruments to see if the chosen attitude is giving you what you want (level flight, climbing, a descending turn, whatever). If not, set a new attitude for the nose relative to the horizon and look at the instruments again a few seconds later. In VFR flight the primary instrument is the nose's position relative to the horizon.

Landing

Don't stare at the runway numbers in front of the nose of the airplane. Keep your gaze centered about halfway up the runway, sort of the same way that you keep your gaze in the middle distance when driving on an Interstate highway. This makes it easier to detect the small changes in aircraft attitude that are critically important. The scene right in front of the airplane's nose doesn't change that much as you yaw and pitch. But the distant portions of the runway move around dramatically as your attitude changes.

You can fly all day midair without using the airplane's rudder. Maybe not super efficiently but you can get where you want to go using only the ailerons and elevators. Landing is different, especially a crosswind landing. The rudder becomes a critical tool in keeping the airplane on the runway centerline and for making sure that the tires are pointed in the direction of aircraft movement so that the gear aren't side-loaded during touchdown. On short final, press relatively hard on *both* rudder pedals. Mostly your left foot is fighting off the pressure from your right. But at least you are consciously working the rudders and, when necessary, will push decisively in the required direction.

There are two things that are hard about landing. One is flying the airplane at landing speed with the wheels just over the runway. Two is flying the airplane just below landing speed with the wheels on the runway. You might say that item two isn't flying but rather taxiing. But in point of fact the ailerons and rudder are still functioning as control surfaces for keeping the plane headed down the centerline. Let's suppose that you do 10 touch-and-gos. How much practice will you get in these two regimes of operation? Maybe 20 seconds (10x2) of flying low over the runway and 40 seconds (10x4) of rolling down the runway really fast after landing. Landings are quick. I didn't learn anything from my first 20 except that the airplane was always in the wrong place and that my instructor tended to start yelling about 10 feet above the ground.

My friend Richard came to the rescue. He suggested that I go up to the Pease tradeport in New Hampshire. The runway at this former military base is more than two miles long (11,300', longer than Logan Airport's longest runway!). Richard suggested trying to fly the entire length of the runway with the wheels just above the centerline, then coming back to land and roaring down the entire remainder of the two-mile runway at 50 knots without lifting the wheels. "Ask for clearance for the 'option' when doing the low flight," Richard noted, "and tell the tower that you want to practice aborted takeoffs for the long taxis."

This was the key. After about 90 minutes of playing around on the Pease runway, I felt confident in my ability to control the airplane on or near the ground at or near landing speed. All this with an instructor I'd never flown with before. Final score: six complete landings with no instructor assistance against one landing where the instructor needed to push the controls a bit. The instructor, Lara Greenwood, noted that the easiest way to land a plane was to try not to land. She said "if you just try to float along the runway as low as possible without landing, eventually you'll sink down onto the runway in more or less the correct attitude." And she was quite right! My best landings were after the long floats. When I concentrated on landing, I would flare too much or too little.

More: *Make Better Landings* (Alan Bramson; 1982; out of print but probably easy to find on the Web, a revised edition from 1994 is supposedly available from amazon.com)

Simulation

According to flight instructors and some of the students that I've interviewed, expert PC flight simulator users don't get their first pilot's certificate all that much faster than raw beginners. On the

simulator you don't get any physical feedback as the plane moves. You can't look around when using the simulator. It is a pretty poor excuse for reality. Why don't they make the kinds of fabulous hydraulic simulators for primary flight students that you see for Boeing 767s and fighter jets? Because a really fancy and realistic flight simulator costs more than a Diamond Katana or Cessna 172. It is cheaper simply to go up in the sky.

The foregoing notwithstanding, Microsoft Flight Simulator (MSFS) is an excellent program, and it might make you feel more comfortable that you can handle unusual situations. If you do set up MSFS, try to do it on a computer with two monitors so that you can open one window on the bottom or side for the instruments and reserve the main monitor for the view over the cowl. My instrument-rated friends report that MSFS was tremendously valuable in learning instrument flying.

Here's what you need for a good home simulator:

- Windows XP or Vista for high quality multi-monitor support
- Microsoft Flight Simulator
- CH Products joystick or CH Products yoke
- rudder pedals: CH Products USB

The Knowledge Test

It is possible to pass the FAA knowledge test (a.k.a. "the written test") without knowing how to fly an airplane, and a passing score is valid for two years from the date of the exam. If you're on a tight budget, it is therefore probably best to do all of your reading and studying before taking your first lesson in an actual airplane. The most successful prep course is from www.kingschools.com. Normally you need an instructor's signoff before you can sit for the exam, but the King Schools can supply the signoff for you. Do the King course, take the exam, learn to fly, then review the material from your knowledge test shortly before your practical test ("checkride").

If you don't mind spending some extra time and money, you could defer studying for the knowledge test until shortly before your checkride. Then you won't have to study twice. Again, however, you'll probably want the course from www.kingschools.com.

(Personal results: I used King Schools courses for Private, Instrument, and Commercial knowledge tests. My scores were 97, 98, and 100 respectively.)

Useful Educational Materials

Aside from the standard textbooks that you'll be assigned by your flight school, I've found the most useful to be the classic *Stick and Rudder* (Wolfgang Langewiesche 1944) and John S. Denker's *See How It Flies* (Web-only). Denker is a PhD physicist who works at Bell Labs and is also an FAA-certified flight instructor.

Another resource is joining Airline Owner's and Pilot's Association (www.aopa.org). Membership is free for student pilots.

Flight training hasn't changed for 50 years. Chances are your question has already been asked, answered, and indexed in one of the aviation newsgroups such as rec.aviation.student. Check http://groups.google.com/ before posting a duplicate!

Food for thought:

- The Art of Failure—Why Some People Choke and Others Panic by Malcolm Gladwell (New Yorker Magazine, August 21-28, 2000)

Motion Sickness

I get violently seasick in any normal ocean swell but have never thrown up on a commercial airline flight. Personally I find light planes in good weather to be somewhat more nauseating than commercial airliners, but nowhere near as bad as a boat. That said, I felt really sick during my first lesson and continued to get queasy whenever my instructor touched the controls. If you tend toward motion sickness, try to find an instructor whose style is to talk you through everything rather than demonstrate and correct with his or her hands and feet. A $100 electronic ReliefBand for your wrist will probably help but the keys to avoiding motion sickness while training are the following:

- Eyes out of the cockpit; fly by watching the nose's position relative to the horizon and periodically check the instruments to see if the visually established attitude is getting you what you want in terms of airspeed and climb rate
- Instructor talking to you instead of working the stick him or herself
- Fly on non-turbulent days

Maybe it will take you a few extra hours to get your certificate but you'll have more fun.

Oh yes, be sure to carry a barf bag for any passengers. In the immortal words of Charles Wright, instructor at East Coast Aero Club, "Having a passenger throwing up violently a few inches from you can be very distracting."

Nearly all Air Force fighter pilots succumb to motion sickness during their training, which of course involves aerobatics. The Air Force does not wash out those students who throw up. If a pilot throws up and then is able to continue the mission he or she is considered a good pilot. It is the pilots who throw up and remain incapacitated who are washed out. The good news is that nearly all Air Force pilots develop a tolerance for aerobatics and stop throwing up. The bad news is that if a pilot doesn't fly for a month or so the tolerance is lost.

Personally I found that motion sickness was less of an issue at 50 hours than 5, less at 100 than 50, and barely a memory at 200 hours. The only way that I can bring on any symptoms is to let a friend fly through bumpy skies while I dig through luggage in the back of the airplane. The foregoing notwithstanding, I still try to avoid turbulence because I find it wearing and uncomfortable.

More

- Very likely a CFI and/or ATP will answer your question in the Aviation question and answer forum on this server.

Piston Airplane Engine Management

The best way to manage an airplane engine is to delegate the task to a computer via a Full Authority Digital Engine Control (FADEC). As the pilot you have much more important things to do with your time and attention. Why not focus on maintaining the correct airspeed and being correctly positioned on an instrument approach while a computer does a much more precise job at adjusting air/fuel mixture and prop speed than you ever could.

Sadly, however, most piston-engine airplanes being manufactured in 2003 offer a three-lever engine control setup that dates back more than 50 years. This article is written for pilots of airplanes with the standard three levers: throttle, prop speed, mixture. It contains some useful information for airplanes that have simpler manual controls. The numbers are appropriate for a Diamond Star DA40, which has a Lycoming IO-360 180 horsepower nonturbocharged engine; you should refer to your airplane's A.F.M. to make sure that they are sensible for your airplane.

Taxi Out

Lean, lean, lean. Your best chance of fouling a plug is right now.

Runup

If you're at a high-altitude airport or taking off from sea level on a hot day, the runup is your opportunity to determine what mixture setting will result in maximum engine power. You do not want to take off full-rich on a hot day. The air is thin, which means that your airplane needs to develop a higher ground speed to reach a given airspeed. Developing a higher ground speed implies achieving a higher kinetic energy, which is accomplished with engine power. If you're not developing near-maximum engine power, your takeoff distance will be extended, possibly beyond the end of the runway!

With the prop speed control set for max RPM and the throttle set to give an approximately correct runup RPM (for a DA-40, 2000 RPM), play with the mixture control to find the spot where the RPM peaks. This is the max power setting and is an appropriate place to leave the mixture control for runup, i.e., nice and lean so that you won't foul your plugs.

After you're done with the runup, push the mixture lever forward "a bunch" (in the DA40 about one inch). This will substantially richen the mixture for climbout, thus providing extra engine cooling, but on a hot day or at a high-altitude airport, it will be much leaner than full rich.

Clearing a Fouled Plug

If your engine failed to run up, i.e., if it ran very poorly on one mag, chances are good that you have a fouled spark plug. This is especially easy to verify if you have a temperature readout for each cylinder of your engine; the cylinder with the fouled plug will be much cooler than the others.

You may be able to clear the plug by running the engine hard and lean, e.g., 2400 RPM and just lean of peak. Keep this up for a solid two minutes unless the cylinder head temperatures become excessive. Then try the runup again.

Some engines are more susceptible to fouling than others. You may want to invest in a set of fine-wire or "iridium" spark plugs. These last almost indefinitely and are virtually immune to fouling. The massive electrode spark plugs that are in most engines do foul and need to be replaced after 500

hours. Why don't airplanes come with fine-wire plugs to begin with? They cost about $55 each, compared to $18 for massive electrode plugs (iridium plugs for cars are about $7 each, compared to $1 or $2 for old-style spark plugs).

If you don't want to go Iridium and you are worried about getting stuck at an airport where no mechanics are available, an alternative is to learn how to change a spark plug yourself, which is one of the things that the FAA authorizes an aircraft owner to do him- or herself. You will need to carry a 3/4" socket, a special spark plug socket, a torque wrench with 3/8" drive, and a regular 3/8" socket driver. And don't forget the spare plug!

Climb

You want to be "way rich" when your engine is working really hard, i.e., producing more than 75 percent power. Without a turbocharger, however, your engine will begin to run out of steam as the air thins. It doesn't make sense to keep the mixture at "takeoff rich" all the way up to 7,000' because it is very likely that by the time you get to 5,000' the full-throttle performance is no better than 75 percent power. The engine doesn't know that the airplane is climbing. It should probably get the same mixture setting that would be appropriate if you were cruising along at 5,000' straight and level using 75 percent power. Unless the cylinder head temperatures go above 400 degrees, it is probably okay to lean for the rest of your climb.

Cruise

If you like a quiet airplane, it is a good idea to throttle back to a low prop speed during cruise flight. You might give up 10 knots, but the vibration and noise will be considerably reduced, as will fuel consumption. If the max cruise RPM is 2400, try 2200.

There are various schools of thought on the "lean of peak" or "rich of peak" debate. Here's how "rich of peak" kept the author alive (excerpt from a Weblog targeted at nonpilots):

Yesterday I flew from Bedford, Massachusetts to Gaithersburg, Maryland. East Coast airspace was complex to begin with and has become further complicated by restrictions around the Washington, DC area. If you're an instrument-rated pilot, you can avoid all of this complexity by filing an instrument flight plan and taking advantage of Air Traffic Control (ATC) services. The assigned route took me straight over JFK airport at 6,000' and then through central New Jersey before proceeding over Balitmore-Washington Intl. airport and into the Montgomery Country Airpark.

My Diamond Star (DA40) is a brand-new design, but it uses an engine that hasn't changed for 50 years. Old-style piston-airplane engines require that the pilot constantly adjust the air-fuel mixture as the plane rises into thinner air or descends into denser air. When you're done with your flight and parked at the airport, you pull the mixture control all the way back to "full lean" and the engine stops, starved of fuel.

Descending out of 6,000' over Baltimore, I noticed that my exhaust gas temperatures were rising, despite the fact that I was enriching the mixture. Between talking to ATC and the other pilots at the busy nontowered Gaithersburg airport, I didn't have much time to reflect on this odd behavior. After parking the airplane, I pulled the mixture control back. The engine kept running. I shut the airplane down by shutting off the flow from the fuel tanks, then hopped out and unscrewed the cowling.

The mixture control itself is an L-shaped arm on the throttle body of the fuel injection system. It is attached to the mixture cable by a bolt. In case the mixture cable snaps, a spring is also attached to

the arm to pull the mixture to "full rich" (engine runs but not necessarily efficiently). Sadly, the engineers at Diamond decided that both the spring and the cable should be attached with the same bolt. The bolt was rattling around loose in the bottom of the cowl. The spring was hanging free. The end of the mixture cable was hanging free. **My engine continued to run because (a) I had been conservative in running moderately rich at altitude**, (b) the difference between 6,000' and sea level isn't enormous, and (c) the L-shaped arm, free to rattle around a bit, hadn't rattled its way to "full lean". [This is more than a theoretical possibility; rumor has it that a plane similar to mine landed in a farmer's field in the Midwest back in the Spring of 2002 after the mixture cable came loose. The incident led to a redesign, which was retrofitted to my airplane in June 2002.]

My mixture control was held together with a regular bolt and a locking nut (that apparently did not lock and is now on the ground somewhere between Long Island and Baltimore). Tull, one of the best mechanics at Gaithersburg, happened to be on the field at 6:00 pm on a Saturday and he reassembled the airplane, this time using a bolt with a little hole in the middle so that a safety cotter pin could be inserted to prevent future separations.

There are a bunch of ways to look at this incident. One is despair at the state of engineering in this world. Had an extra hole been drilled in the L-shaped arm, the spring could have been attached separately from the mixture cable. The engine would have gone to full rich after the mixture cable detached. Alternatively, Diamond could have used a bolt with a hole in the middle and a safety, like the one that the mechanic in Gaithersburg used. A few extra cents and the plane would have been spared the risk of an emergency landing.

Another way to look at this incident is to be ever-vigilant when flying a piston single-engine airplane: have an emergency landing spot in mind at all times. The #1 reason for engine stoppage is running out of gas, but it apparently is not the only reason.

Had I been running lean-of-peak, my engine probably would have quit as I came down out of 6,000'.

I've found that peak exhaust gas temperatures are around 1525-1550 degrees F. I lean until I see 1450-1475 (i.e., about 75 degrees rich of peak).

Descent

There are two schools of thought for managing mixture while descending.

School 1 suggests that you're going down to where the air is thicker so you should richen preemptively. If you plan to land, in fact, why not go full rich while at altitude so that you don't have to think about mixture again?

School 2 notes that you're probably cutting back engine power while descending. You don't want to come screaming into the pattern at 150 knots. Pulling back engine power cools the cylinder heads. Richening the mixture cools the cylinder heads. To avoid damaging the cylinder heads from shock-cooling, why not let the mixture get leaner as the airplane descends and the power comes back?

The risk with School 2 is that you forget to go full rich before landing and the engine might therefore quit as you're attempting to go-around.

Landing

You always want to be ahead of the airplane. On downwind this means saying to yourself "after I turn base I'm going to push the prop speed and the mixture controls fully forward". Always have your next move in mind.

Go-Around

It won't cost you anything extra to feel the prop and mixture controls after opening the throttle for a go-around. Just double-check that they are fully forward.

Clear of the Runway

Lean, lean, lean. If you don't want a fouled plug to spoil your next runup, lean aggressively whenever you are taxing. Add this to your "clear of the runway" checklist.

Shutdown

Remember that an airplane engine's ignition system does not require battery power, only a bit of rotation translated to the magnetos. So that your prop does not become a loaded weapon, generating an explosion when touched, you want to make sure that the cylinders are emptied of their explosive fuel-air mixture. Shut the airplane off by pulling the throttle back to idle, double-checking that all avionics and electrics are off, then **mixture, mags, master.** Pull the **mixture** control back to full lean. After the engine jerks to a stop, turn the **magneto** (ignition) key to off. Then shut off the **master** switch.

Some flight schools teach a "burn-off" procedure in which the throttle is opened to about 1600 RPM, the engine is leaned for max RPM and run for 30 seconds, and finally the throttle is pulled back to idle before the mixture is pulled full lean for shutdown. This procedure may result in cleaner spark plugs and therefore less chance of fouling.

General Aviation Safety

All life is the management of risk, not its elimination.
-- Walter Wriston, former Chairman of Citibank
The idea of plunging thousands of feet straight towards the ground and then exploding in a fireball seems to bring out the bourgeois fear of death in many people.

First of all, let's be clear that dying in a plane crash of any kind is one of the hazards of wealth. Welfare mothers sitting at home watching soap operas are not going to become victims of the Islamic Jihad on a commercial flight. A Walmart greeter is not going to take a vacation on a private island so exclusive that it can only be reached via chartered Cessna 182. The Kennedys keep dying because they are rich enough to become expert skiers and fool around on the slopes. Or rich enough to buy their own airplanes and crash them into the water at night.

How dangerous is flying? There are 16 fatal accidents per million hours of general aviation. It is fairly safe to assume that when a plane crashes and someone dies, everyone on board dies. By contrast, the death rate for automobile driving is roughly 1.7 deaths per 100 million vehicle-miles. Car crashes don't always kill everyone in the car so let's use this

statistic as provided, which is for an individual traveling in a car rather than for the entire car. So considering that the average airplane accomplishes a groundspeed of at least 100 miles per hour, those million hours of flight push the occupants of the plane over more than 100 million miles of terrain. Comparing 16 fatal accidents to the 1.7 rate for driving, we find that flying is no more than 10 times as dangerous per mile of travel. And since most accidents happen on takeoff or landing, a modern fast light airplane traveling a longish distance might be comparable in safety to a car.

We can also look at safety per hour. This makes sense for recreational pilots who have the alternative of spending a few hours flying around or spending those hours taking a scenic drive. If the average speed of car travel is 50 miles per hour, those 1.7 deaths occur in 2 million hours of driving. This makes general aviation, with 16 deaths per 1 million hours, roughly 20 times as dangerous per hour than driving.

Risk management is much easier with airplanes than with cars. In a car, you are constantly at the mercy of other drivers. If an 18-wheeler crosses the yellow line, you're toast. Except in the immediate vicinity of a busy airport, traffic is seldom an issue for pilots. If you die it is because something went wrong with your plane or because you flew it into the ground by mistake.

If you don't want to die like JFK, Jr., who became disoriented on a dark and hazy night over water, don't fly at night or don't fly at night unless you're absolutely sure that it will be clear with a bright moon. If you don't want to die when a 25-year-old part fails in mid-air, get a new airplane.

If you're really really scared, try flying commercial. Big airliners have a fatal crash rate of 0.34 per million flight hours, approximately 50 times safer than general aviation. Try to avoid that final commuter hop, though. Those smaller turboprops crash 10 times as frequently per hour of operation, making them only 5 times as safe as general aviation. See the FAA's Aviation Safety Statistical Handbook for more detail.

Better yet, stay home, crack open a 40 oz. malt liquor, and turn on the TV. It is difficult to get seriously injured falling off a sofa.

More aviation safety statistics:

- AOPA Air Safety Foundation publications, notably the annual Nall Report.

Why a Beginner Pilot Can Be Safer than a Retired Fighter Jet Pilot

A pilot with any level of skill can be a safe pilot. The real question is "What is the ratio between the pilot's confidence level and skill level?" A guy who got his license yesterday and will only fly today if the wind is calm and the sky is free of clouds is probably safer than the gal who retired from flying jets for the Air Force and thinks that she can handle ridiculously gusty winds and instrument approaches down to minimums. The experienced pilot can fly a given fixed mission more safely, e.g., taking a Cessna 172 around the pattern on a sunny day. But if the two pilots are allowed to make go/no-go decisions about cross-country flights in marginal weather the end result may be that the novice pilot elects to wait a day and takes less overall risk.

The Most Dangerous Words a Pilot Can Say

"I will be there on June 5 at 6:00 pm." Pilots of light aircraft who utter sentences of that form are very high risk pilots, regardless of skill level. If you promise to get to specific places at specific times you

will eventually run afoul of weather and other circumstances that are beyond you and your aircraft's capabilities.

Consider JFK, Jr.'s famous last flight. He wanted to get a passenger to Martha's Vineyard on a particular evening. Some folks blame the fact that the weather was dark, hazy, and marginal VFR. Some folks blame the fact that JFK, Jr. chose to fly mostly over the featureless waterscape of the Long Island Sound instead of over the well-lit sprawl of the mainland. Some folks blame JFK, Jr.'s failure to complete his instrument rating before the accident flight. Some pilots reassure themselves by noting that they've completed much more challenging instrument flights than JFK, Jr.'s simple summer trip to Martha's Vineyard. All of these perspectives are reasonable but all ignore a fundamental fact: using a small aircraft for scheduled *transportation*, as opposed to *recreation*, is an accident waiting to happen.

How do the airlines manage to keep their schedules and safety records intact? An airliner has jet engines that enable it to climb over most weather and therefore the airliner doesn't spend much time in the clouds. An airliner has de-icing equipment for climbing or descending through clouds that are below freezing and might ice up the wings. An airliner has two pilots in the front who do nothing but fly instrument approaches all day every day. An airliner usually goes from one big airport with instrument landing systems and RADAR-equipped controllers. A private pilot with a little single-engine piston-powered airplane doesn't have any of this going for him or her, especially not when going to a favorite out-of-the-way airport.

A safe attitude with a small airplane starts with the assumption that no flight is going to be made at the time and date planned. It might happen if the weather happens to be good and the flight looks as though it will be enjoyable. The plane is a recreational toy with transportation as a side benefit.

Example of how this works in practice: I planned a flight from Boston to Washington, DC for Thanksgiving with my parents. I left Boston on Tuesday because the forecast for Wednesday was rain. I stopped in Teterboro, New Jersey to see some cousins on Tuesday night, planing to proceed to DC on Thursday morning when the rain had cleared out. By Thursday morning it was still raining in New Jersey but not enough to make an instrument flight unsafe. However, down in Washington, DC the surface winds were gusting up to 50 knots and Boeing 737s were reporting "severe turbulence" at the altitudes where I expected to fly. I had my dog Alex with me and didn't think he would enjoy being slammed around. So I ended up being 24 hours late for Thanksgiving dinner and took three days to do a trip that could have been done by car in 8 hours.

Example #2: As a novice pilot I took a trip from Boston to Alaska to Baja, Mexico and back to Boston. On at least 10 occasions I had to wait a few days or change plans in order to avoid situations that were frightening and/or beyond my capabilities as a pilot. I managed to complete the trip, however, without ever getting into an unsafe or even especially challenging situation.

Your Tax Dollars at Work

What is the Federal Aviation Administration (FAA) doing to improve general aviation safety? Not as much as it could. For example, as a pilot it is very nice to know about the portion of the earth over which one is flying. How high is the terrain underneath me? Over to the left? If I am forced to start descending out of the clouds due to ice forming on my wings, which way should I go for maximum terrain clearance? Are there any radio transmission towers nearby that I might hit? All of these questions are answered by reference to paper charts called

"sectionals" published by the FAA. A new small airplane in 2002 comes equipped with large high resolution color displays and powerful computers but cannot show the pilot answers to any of these questions. A pilot planning a cross-country trip must juggle about 20 of these charts in the cockpit and constantly plot his or her position on the paper chart, while dividing attention between the displays on the panel and the paper.

Because the FAA does not publish the charts or the underlying terrain database on its Web servers, a typical $20,000+ avionics package for a small plane will have no provision to accept these data even if they were available. It is possible to buy the information in electronic form but only from a private company whose prices are beyond the reach of the average general aviation pilot (the company is Jeppesen, which is a division of Boeing and whose customers are primarily airlines). Thus the device market is stunted because the underlying data are trapped in government-published paper. A user of the $50 Microsoft Flight Simulator program gets more terrain information than the pilot of a $250,000 airplane.

If it is a lack of budget that prevents the FAA from putting their charts on a Web site one wonders how the FAA manages to send out so many nicely printed mass mailings to the nation's more than 600,000 certificated pilots.

More

- Ask the pilot community at the Aviation Question and Answer Forum.

Reader's Comments

172 Crash at Kagoshima, Japan

2002-1-04, Pilot(46 yrs),and co-pilot seat were dead, son of pilot, 16 and friend were survived. After, Sea Diving trip. Kagoshima, Japan

-- Teruo Miyagawa, January 6, 2002
It's not entirely true that the factors in aviation safety are hard to do anything about. Something like half of all GA accidents are related to either flying into clouds while not instrument-rated and current, or running out of fuel. It's easy to avoid both of those.

The fuel-exhaustion accidents aren't usually fatal, but loss of control in instrument conditions almost invariably is.

Joe

-- Joe Thomas, February 11, 2002

The Kennedys keep dying because they are rich enough to become expert skiers and fool around on the slopes. Or rich enough to buy their own airplanes and crash them into the water at night.

Der Philip I think the above remarks are insensitive. Not that I consider the Kennedys special souls than other mortals. But accidents and tragedies do happen and for reasons we may or not know best, should avoid using the fate of others as examples on why flying can be dangerous.

No offense intended Chris Desouza

-- Chris Desouza, February 16, 2002

You fail to point out that at 0.34 fatal commercial airline crashes per million flight hours, if I flew for every hour of my life then I would expect to wait for about 350 years before I died. Surely this statistic suggests that being alive is riskier than flying?

-- James Smith, February 16, 2002
For sensible statistics on air safety visit THIS SITE

-- James Smith, February 17, 2002
As a co-techie contemplating aviation as a hobby, I carried out a similar back-of-the-envelope risk assessment recently, with similar conclusions. However, I approached it by trying to answer the question 'How likely is it that I will die in a plane during a lifetime of recreational flying?'.

Assuming, say, 4hrs flying for just under half the weekends in a year, spread over 30 years of active flying gives an approximate lifetime total of 2500hrs. So the chance of dying is (16/10^6)*2500 - a rather scary 4%.

But compare that to a lifetime of commuting 20,000 miles a year and you get around a 1.4% chance of dying in a car.

So flying isn't so bad after all.

-- Jim Hanmer, April 5, 2002

I suggest you seek help in battling your fear of flying; you are obviously suffering from a phobia, probably induced by what you see in the media which is hardly reliable.

As a pilot myself i can tell you that flying is far safer than you protray, usually. The VAST majority of GA accidents are caused by weather and, specifically, rookie and even experienced pilots who end up flying into it. With proper maintenance, the probability of a component failure in an aircraft is quite rare. Most accidents do not occur during takeoff and landing in GA - it occurs when pilots fly into poor weather situations, which can be attirbuted to the poor quality of flight instruction at many "be a pilot in a month" type schools.

Yes, fewer airliners crash than GA aircraft, but put into perspective how many MORE g.a. aircraft there are in service... the crash rate ends up being about equal. Also, a GA plane crashes, for example, worst case scenario 6 people lose their lives. An airliner crashes, worst case scenario 400 people lose their lives.

It is not fair to attribute flight safety with the size of the aircraft; nor can you compare flying with driving. It just doesn't work. Before you go out and blame aviation for deaths of celebrities and announce that flying is a death trap, please do your homework to avoid looking like such a moron.

CM

-- Captain Matt, April 19, 2002

Though driving is safer than GA, you can actually control the risk factors much more in GA. For example there is very little chance of being hit by a drunk pilot.

On the other hand if you fly only in good weather, to large obstruction free runways, in a well maintained modern plane and most importantly fly over flat terrain where you can always make an emergency landing - GA is much safer than the averages suggest.

In addition the accident record is clear than experienced pilots get into trouble not becuase of lack of skill - but because of lack of judgement. Another intersting quesion is how many GA accidents are suicides. There are very few accidents overall, and there are many accidents that are so stupid that one has to wonder if many are not high risk flights by pilots who don't care if they survive. These could greatly effect the statistics.

The safest flying I know of:

There has never been a fatal accident in a Katana in the US and only 1 worldwide. They have a stall speed of 38kts, a glide ratio of 15-1, and a very strong seat/cockpit design.

This may not be the most exciting flying in the world. But it is a lot more exciting than crusing down the freeway.

-- Larry Sama, May 13, 2002

My boyfriend recently crashed the Piper he was flying during takeoff. He had engine failure and crashed through power lines into someone's front yard. The wing fell off, fuel was spilling all over him, but remarkably, he walked away with cuts and bruises. He had borrowed the plane from another pilot and had flown it for a year without any problems. I'm terrified of him flying again. I'd really like some reliable statistics to gauge the risk of flying small planes.

-- jen Ho, August 8, 2003
One more comment... I've been a pilot for some years and there are very few people in the US that can pilot a plane and the beauty of flying a plane is more them most people could ever experience in a lifetime. I've seen more beauty then most could ever imagine. I've also been in several emergency situations but I assure you that with the intenense training of being a pilot you are apped for most situations. When you are up a 10000 feet with the moon gleaming off a big lake you realize that in your lifetime you out of very few will ever experience that beauty.

I guess I could spend my life smoking and drinking not to accomplish anything in life or fly a plane knowing I've accomplished what billions of others only dream of, so I guess it is all about choices.

-- James Paul, May 17, 2005

GA is a hobbie just like collecting motorcycles, playing sports or what so ever... The thing I can assure you of is that pilots are the most highly trained of all. Accidents happens and I don't know what is safer but sometimes you have to ask yourself are you really doing what you love to do? If you put GA in perspective to motorcycles and to some sports there is no comparison. So many people get wrapped up into comparing GA to cars when really there is no comparision as the proportions don't

compare but after watching my mom pass do to cancer which kills more people then both combined. I have to believe that you have to let people fullfill there dreams. You can never tell someone their chances are greater one way or the other, because you are limiting their dreams and hence are they truly happy.

-- James Paul, May 17, 2005
I survived a plane crash in Dijon, France in 1998...We were flying in a Rockwell Commander (4-seater). Both the pilot and co-pilot (who was a Flying Instructor/Examiner) were killed instantly. Both myself and the other passenger sustained critical injuries. Prior to the accident, I myself had flown light aircraft for just under 100 hours in the UK. I witnessed many near-misses and often heard of planes creashing,usually on landing. From my own experience and of hearing of the circumstances of other light aircraft crashes invariably it is put down to pilot error or occasionally bad weather (but then in my mind a good pilot wouldn't take chances knowing the weather may change....).

I think some people, once they have their PPL, become laisez-faire and very often, especially when taking friends on trips, tend to show off and that's where the trouble lies. They also become complacent. Of course, not all pilots act this way but many do.

-- jan mansfield, August 6, 2005

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