Rod Machado's Plane Talk

A Collection of Rod's Most Popular Aviation Stories and Articles

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Foreword

A month seldom passes without someone asking me to recommend a flight instructor. Although I am acquainted with many instructors, I am unable to recommend one because I have not flown with very many and cannot judge their ability to instruct.

In each case, however, I stress the difference between an instructor and a teacher. The former is certified by the Federal Aviation Administration to provide flight instruction, but this alone does not mean that he knows how to teach. Many instructors convey information and procedure in rote fashion. Teachers, however, go beyond the do-what-I-do demonstration and tailor their style and presentation to suit the individual student's needs. Fortunate indeed is the student whose instructor is also a teacher, for he will learn far beyond that which comes from merely repeating a maneuver or a fact of flight until a modicum of proficiency and knowledge has been attained.

That you are reading this foreword implies that you are among the fortunate. This compendium of flight wisdom and advice was written by a genuine teacher, a Grand Master. If you have not already met Rod Machado through his other written works, then it pleases me to introduce you to him.

Machado is one of those rare instructors because of his unique and remarkable flair for instilling knowledge in others. He goes beyond simply repeating what he has learned by teaching in a way that makes the advice and information stick. Beyond that, he makes the learning enjoyable by wrapping deadly serious subjects in his inimitable brand of humor. (If you have not attended one of his live presentations, then you must make it a point to do so.) I have been flying for more than 50 years and never before have I encountered anyone who makes learning the nuances of aviation so enjoyable and so indelible.

Rod Machado is a good friend, and it is with honor and pride that I now leave you in his exceptionally capable and knowledgeable hands. Have fun.

Barry Schiff
Captain, TWA (retired)
Los Angeles, California

The Truth About Good Pilots

My friend Larry had 23 confirmed kills in Vietnam. Unfortunately, he wasn't a pilot. He was a cook.

OK, he really didn't terminate anybody. But word has it that everyone brave enough to eat his quiche lost their will to live. It was the *quiche of death*.

When we hear that someone's a *good cook,* we immediately know what that means. Their meals are pleasing to the palate, and the numbers 9 and 1 don't show excessive wear on their kitchen's phone pad. But what does it mean when someone's described as a *good pilot*? It is, after all, a term used more often than a corkscrew by the French resistance on Bastille Day.

The appellation *good pilot* is frequently used to describe an aviator's ability to land an airplane. No doubt, this skill is important. You should be able to get an airplane on the runway—preferably, the one you're aiming at. But should we judge you only by your ability to squeak the tires or perfectly straddle a centerline?

The unfortunate fact is that we place an exaggerated value on stick and rudder skills. Here's proof.

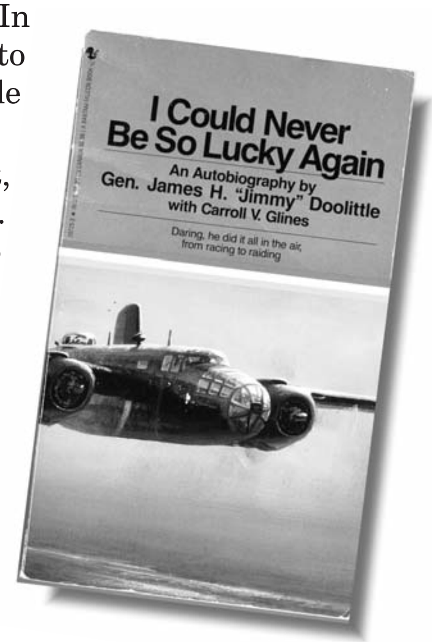
Ask some pilots how they'd use a free hour of dual instruction with airshow pilot Bob Hoover or X-15 test pilot Scott Crossfield. Most will insist on learning esoteric flight skills. Loops and landings with engines shut down or whifferdills while pouring iced tea into a glass are a few of these. What an unfortunate use of a golden hour. It's the aviation equivalent of slipping Leonardo's Mona Lisa under your car to catch dripping oil.

The best use of that hour would be to avoid the airplane altogether. Buy two sodas, find a quiet bench and ask questions—lots of them. Activate the brain instead of the adrenal gland. If you prize thinking skills over flying skills, this is exactly what you will do when your opportunity comes knocking.

I've had the good fortune to meet many aviators of this caliber. A few were famous, but most were ordinary, just like you and me. Their ability to fly was never in doubt. That's not, however, what distinguished them. They were *good pilots* because of how they thought. They knew how to search for the *truth*—and find it.

Flying truths are acquired through personal experience, by experimentation. It's a simple but effective three-step process involving *hypothesizing, predicting* and *experimenting*. The results provide the currency by which we purchase safe passage in airplanes. It is, by the way, the same process scientists use to find out what's true about everything else in the world.

General Jimmy Doolittle understood this process well. In the early 1930's, pilots of the Gee-Bee (R1) racer seemed to spend as much time crashing as they did racing. Doolittle showed up, and did-a-lot.



He took one look at the *little monster*, as he called it, then developed a hypothesis and made a prediction. "Recognizing that this airplane would be extremely hot to handle," Doolittle wrote in his autobiography *I Could Never Be So Lucky Again*, "I knew I had to fly it delicately. I walked around it several times to try and *predict* what it would do in flight."

Prediction in hand, Doolittle proceeded to test his hypothesis. Climbing the stubby 300 MPH airplane to 5,000 feet, he attempted the same type of steep turn that race pilots do around pylons. Without warning, he promptly did two snap rolls before regaining control. This ended the experiment. Later he commented that the Gee-Bee was the most dangerous airplane he had ever flown.

His experiment paid off. He concluded that the best way to race the Gee-Bee was to use its speed to remain outside the other pilots in the race. He would climb between pylons and dive before each turn. His theory worked, winning him the coveted Thompson Trophy.

Doolittle was a skilled pilot, but that's not what kept him safe. Pilots of equal or greater flying skill had careers that culminated in mounds of smoldering, twisted metal. Doolittle was a good pilot because he knew how to experiment. It's how he discovered the simple truths about what was possible in an airplane.

Have you ever begun a sentence with the phrase, *It seems to me that*…? If you have, then you were constructing a *hypothesis*. This is a tentative explanation about how you think the world might work. It's the first step in experimenting.

It seems to me that I can make perfectly coordinated turn entries by watching the airplane's nose over the cowling without having to look at the inclineometer. Nice hypothesis, but does it reflect the truth about how airplanes work? You can't tell yet. You need to make a *prediction* first, then *test* it to see if it's true.

When you begin a sentence with the phrase *I'll bet that*…, you're making a prediction. This is the second step in experimenting.

Suppose you said, *"I'll bet that applying just enough rudder to keep the airplane's nose (the longitudinal axis) pointing nearly straight ahead while rolling into a turn results in precise coordination during the roll-in."*

The only way to know if that prediction is true is to test it by *experiment*. This is the third and final step in the truth gathering process. Go ahead. Try it and see if it works.

Begin a turn while looking straight over the cowling. Apply just enough rudder to keep the nose pointed straight ahead. Don't let the longitudinal axis move during the roll-in (at least don't let it move opposite the direction you want to turn). Once the bank is established, manipulate the ailerons as necessary to maintain the desired bank. Entering the turn this way results in excellent coordination. And it's done without peeking at the instruments.

Congratulations! You've just discovered an important truth about flying.

Of course, your hypothesis becomes more credible each time it's reaffirmed by additional experimental evidence. With enough successful experiments, you can claim your hypothesis to be a *law* of flight.

"Flying truths are acquired through personal experience, by experimentation. It's a simple but effective three-step process involving hypothesizing, predicting and experimenting."

Now you can better predict what will happen to you in an airplane. You'll never need to call the Psychic Hotline for aviation insights again. Besides, every time you call them they'll tell you they see a big phone bill in your future.

While reading Doolittle's biography, it became apparent to me that he was always testing the validity of his ideas. This is why he became known as *the master of the calculated risk*. His active mind kept *hypothesizing*, *predicting* and *experimenting*. It's what made him good and kept him safe. It can do the same for you.

There is a catch. Not all your experiments will confirm your beliefs about how the world works. In these instances, it takes tremendous courage to stop the experiment and admit that your hypothesis is wrong. Good pilots, however, find searching for the truth more important than maintaining the appearance of it.

When our perception of truth doesn't match reality, we are vulnerable. During a flight review I asked one pilot what frightened him most, and how he'd handle it if the scenario came to pass. "Elevator seizure," he replied, "If the elevator got stuck, I'd shift my weight to control the airplane's pitch." I replied, "OK, let's see if that works."

He had the hypothesis and the prediction, but never completed the experiment. We tested his theory during an actual landing. As hard as he tried, it was difficult to muster a significant pitch change with weight shift in his Cessna 172. Flaring was out of the question. He did, however, reach his target heart rate early that day.

By *hypothesizing, predicting* and *experimenting,* we developed a technique that worked in *his* airplane. It involved applying partial flaps and using power for pitch changes. He was one step closer to the truth about how airplanes work. He was a better pilot for it.

Because of the way they think, good pilots experience less disparity between truth and reality. They are more capable of predicting what will happen to them in an airplane. This thinking skill, rather than any particular mechanical skill, is the essential quality that makes these pilots good.

Perhaps one day we'll place a higher value on how pilots think, than on their stick and rudder skills. We may even hear the following conversation at an airport:

"That Fred is a good pilot, isn't he?"

"He sure is. The guy knows how to find the truth about airplanes. I'd let my family fly with him any day."

"Yeah, but his landings could sure use some work."

Flyout at the O.K. Corral

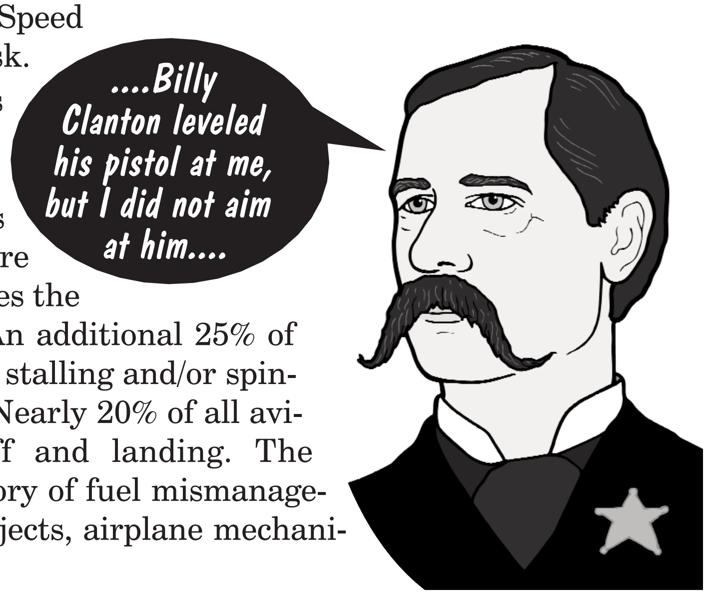
"When Billy Clanton and Frank McLaury drew their pistols, I knew it was a fight for life.... Billy Clanton leveled his pistol at me, but I did not aim at him. I knew that Frank McLaury had the reputation of being a good shot and dangerous man, and I aimed at Frank McLaury. The first two shots were fired by Bill Clanton and myself, he shooting at me and I shooting at Frank McLaury. I don't know which was fired first. We fired almost together. The fight then became general."

Those words were spoken by Wyatt Earp at the O.K. Corral inquest. Bill Clanton, Frank and Thomas McLaury died during the shootout. Wyatt escaped unscathed. Luck? That seems unlikely.

When Wyatt Earp wasn't acting as a frontier lawman, he made his living as a gambler and speculator—pursuits that require an ability to assess risk. Wyatt Earp was more than lucky. He was an excellent risk manager. That's why he aimed at Frank McLaury first, despite being fired upon by Billy Clanton. The qualities that kept Wyatt free from ever being wounded in a fight can also help keep you safe in an airplane.

The basic equation for risk assessment is relatively simple. Find out where the risks are, then minimize your exposure to them, taking into account various costs (financial and other). Having minimized your exposure, you then compensate as much as possible for the residual risk. There's no magic here. It's a process that's appropriate during flight or a gunfight.

How do you know where the risks are? Several models for risk assessment exist, but the simplest way is to identify how, when and where people get hurt most often (or come close to getting hurt). Freeway driving is a good example. According to the California Highway Patrol, if you like cruising at 70 MPH on the freeway, you stand a 50% chance (1 in 2) of being killed if you are involved in an accident. Slow to 55 MPH and that risk is reduced to a little over 3% (1 in 32). Speed is risk. The more of it, the higher the risk.



Reading aviation accident reports is perhaps the most common way pilots identify areas of risk. A thorough search of the NTSB database reveals that 25% of all aviation accidents are weather related, with 40% of all fatalities the result of an encounter with weather. An additional 25% of all aviation accidents result from pilots stalling and/or spinning their airplane into Planet Earth. Nearly 20% of all aviation accidents occur during takeoff and landing. The remaining accidents fall into the category of fuel mismanagement, getting lost, taxiing into solid objects, airplane mechanical problems and so on.

So, according to the accumulated accident data in NTSB reports, where are flying's greatest risks? Weather certainly appears to be the leader in both accidents and fatalities. Flight into IMC (instrument meteorological conditions) is responsible for a large portion of the accidents involving VFR pilots. Many of these accidents involve *scud running*—aviation's version of Russian roulette. On the other hand, IFR pilots experience weather problems in the form of ice, thunderstorms and low visibility approaches, especially when the approach is conducted at night (an IFR pilot, for instance, is 10 times more likely to have an IFR approach accident at night than during the day).

An inability to recognize and prevent those situations that result in a stall or spin is neck-and-neck with weather accidents as a cause of problems.

A basic inability to make the airplane do what the pilot wants it to do during takeoff and landing is another major cause of accidents. Stalling and spinning, as well as takeoff and landing accidents can all be lumped under a single category—*an inability to exercise basic control of an airplane*. Where are the risks now? It appears that the majority of risks in aviation are due to a pilot's inability to properly fly an airplane, with weather being a close second.

Now that you know where the risks are, what can you do to minimize your exposure to them? Your salvation lies in learning how others have successfully dealt with risks, then mimicking their behavior. There are two ways you can learn how to do this. You can either read a lot of books or you can ask a lot of questions. Better yet, do both. Let's examine the first option, reading books.

It's important to think about books (and magazines as well) as more than just pages and pages of bland text rolled onto paper. I like to think about books as an author's thoughts and experience frozen in print. For those authors no longer with us, a book becomes the frozen thought of our ancestors. Reading can be thought of as the transmission, or downloading of information from an author's mind to your mind. And there are many good books worth downloading into your psyche.

You might begin by reading *Stick and Rudder* by Wolfgang Langwiesche, then dive into Bob Buck's *Weather Flying*, followed by a head-first jump into Barry Schiff's *Proficient Pilot* series. And there's much more out there to feed your hungry pilot brain. To put it simply, if you're flying and you're not reading, then you're not learning—at least not learning as much as you could be.

Of course, many pilots elect to read NTSB accident reports in their quest for insights on how to better cope with some of aviation's greatest risks. There's nothing wrong with this, as long as you realize that those reports weren't designed to provide you with practical information on how to avoid those risks. The primary objective of those reports is to identify the cause of an accident. They aren't designed as educational tools to be used by a pilot in overhauling the aviation portion of his or her brain. That's why reading NTSB accident summaries often seems similar to eating the last potato chip in the bag: you end up wanting more (information), but there's no more (information) to be had. It's foreplay without the payoff.

For instance, one NTSB report of a stall spin accident states, "...the probable cause of this accident was the instrument rated private pilot's inadvertent stall when circling to land." Hey? Where are the rest of my chips? It seems just as meaningful to say, "The accident was caused by the pilot hitting the ground too hard. We recommend not hitting so hard next time."

The NTSB does the best it can with the information it has. That's why NTSB accident summaries read like the Surgeon General's warning on cigarette packages: *Warning: Flying low and slow can be hazardous to your health*.

If you attempted to draw conclusions about how to minimize the risks of flying an airplane from these reports, you'd probably never fly when any cloud is present. You'd probably never want to fly without 10 miles visibility and you'd probably feel compelled to refuel at every airport whether you needed to or not. Then again, you'd probably avoid airports, because that's where the majority of collisions occur. Frankly, you'd never fly. From initial appearances, it just wouldn't be worth it.

Remember, to star in an NTSB summary you must have done something wrong—like crash an airplane. Attempting to learn proper judgment and correct flying techniques with these reports as your sole source of education is like taking an accounting class

from a prison inmate who's doing time on an embezzlement rap. You'll either not learn much, or you'll learn the wrong thing. Accident victims teach us where the risks are. Pilots exposed to similar risks and who fly accident free, however, are the ones who can teach us how to avoid these risks. These are the people you also want to talk to and read about. So, the next time you're in the presence of a skilled pilot, ask him or her both of my trademark questions for learning good judgment.

The first question is, "What was the most important thing you learned that has kept you safe in an airplane?" This question usually generates a bit of philosophy about how to think properly as a pilot.

The next question is more specific to flying technique. It asks, "What is the most important physical piloting technique you've acquired that has help you pilot an airplane safely?"

I really enjoy the response this question generates. Some pilots tout the benefits of stick and rudder skills, while others stomp their foot in favor of looking outside the cockpit. The responses often appear varied and unrelated, but only at first. Soon, you'll begin identifying patterns in these responses that will help you establish important priorities when building your foundation of piloting skill.

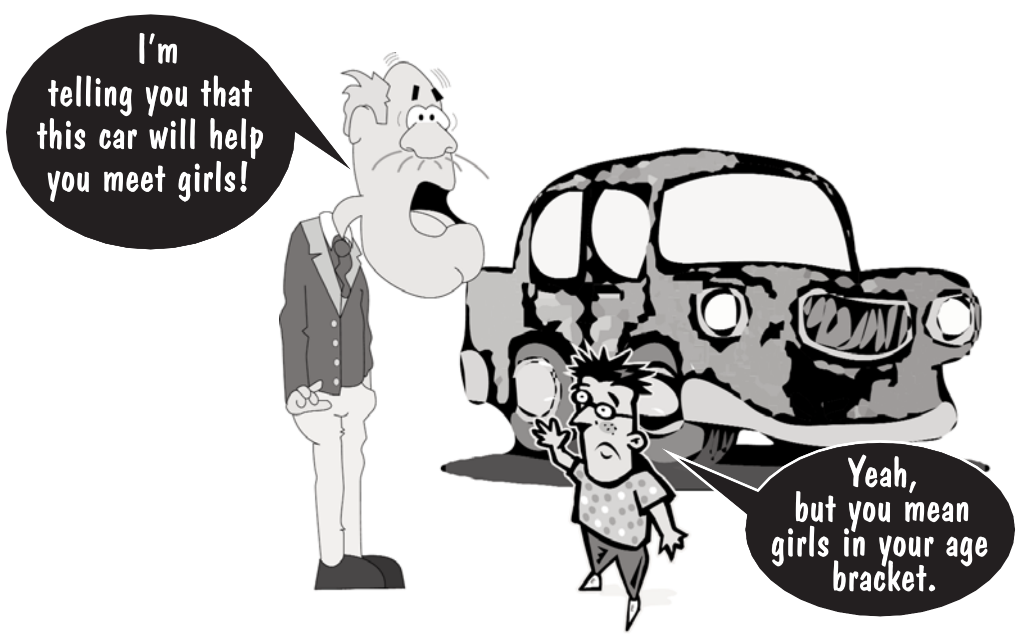
Wyatt Earp once said, "The most important lesson I learned from those proficient gunfighters was the winner of gunplay usually was the man who took his time. The second was that, if I hoped to live long on the frontier, I would shun flashy trick-shooting—grandstand play—as I would poison." It seems that Wyatt learned more on how to survive from proficient gunfighters than from those who weren't.

In My Humble Opinion

We do not at present educate people to think but, rather, to have opinions...

Louis L'Amour

When I was in high school and ready to purchase my first car, my grandfather suggested that I buy our neighbor's less-than-stylish, ancient Rambler coupe. He said girls would love that car. He was right, although I didn't realize he meant girls in his age range. That's what I get for basing my opinion on the advice of someone who thought being *cool* was something you could measure with a thermometer.



Opinions are important to us, especially if we fly airplanes. They act as the explanations we use to describe, define and even predict our cockpit experience. With each formulation, the world aloft appears slightly less spooky and a lot more friendly.

Unfortunately, our opinions are not always based on fact. More often, they are beliefs or conclusions held with confidence but not substantiated by positive knowledge or proof. That's why opinions are *tentative* but not necessarily *final* explanations. Without subjecting them to the rigors of rational thought, we fool ourselves into believing that we're more certain of the world than we actually are. To confuse opinion with truth is to mistake the moon for the finger that points to it.

Several years ago I flew with a fellow who, upon beginning a high turn to base leg, touched the flap handle, then immediately released it as if it were a hot coal. He applied flaps only after rolling out of the base leg turn.

"Why did you release the flap handle during the turn?" I asked.

"I no longer apply flaps in a turn," he replied,

"Oh, really? Why is that?" I queried, to which he responded, "A fellow pilot recently told me that it's dangerous to apply flaps in a turn."

"Did he give you a reason?" I queried.

"Nope, he just said it was a dangerous thing to do," he responded.

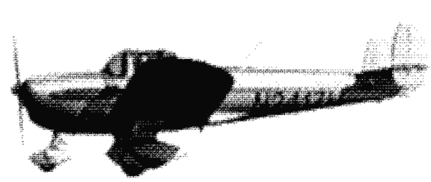
Is there any validity to this idea? In my opinion, no. Other than the possibility of distraction, there's no fact-based reason for avoiding flap application in a turn.

Of course, someone might suggest that a *split flap* condition resulting during flap application in a turn might roll the airplane into a dangerously steep bank. This assumes that the inside flaps fails to extend first. It also assumes that a pilot won't catch the problem and immediately return the flap handle to its previous position. After all, an important rule about flying says: if you touch something in an airplane and it results in something bad happening, then you return the suspect handle, knob or lever to its previous position. A review of the NTSB accident database regarding the typical general aviation production airplane doesn't indicate or even suggest that the application of flaps in a turn is causing pilots to fall from the sky as a result of a split flap condition.

Suppose this fellow had an engine failure and needed to descend quickly while turning toward the only available landing spot. A delay in applying flaps could result in overshooting the field. In this instance, his opinion regarding flaps seems more like the aviation version of an Elvis sighting—it rests on grounds insufficient to produce certainty. Herein lies the danger of confusing opinion with truth.

Unlike some activities, aviation is a business where pilots prosper or perish by their opinions. After all, if an angler has a few wacky ideas about catching fish, it's unlikely he'll end up being grilled by a grouper. The odds against such an aquatic fate are heavily stacked in the fisherman's favor—as long as he's just a teeny bit smarter than the trout he's trying to catch. Pilots with loony ideas, however, are more likely to end up filleted.

A former Ercoupe owner once told me how he bragged to his buddies that his airplane was unstallable. One Saturday morning they challenged him to prove it by approaching and landing with his elevator held full aft. One bright fellow even volunteered to ride along as a witness. The results? He not only landed on the numbers, he remained on them, too. He suffered minor back injuries when the airplane pancaked and made the shortest Ercoupe landing in history.

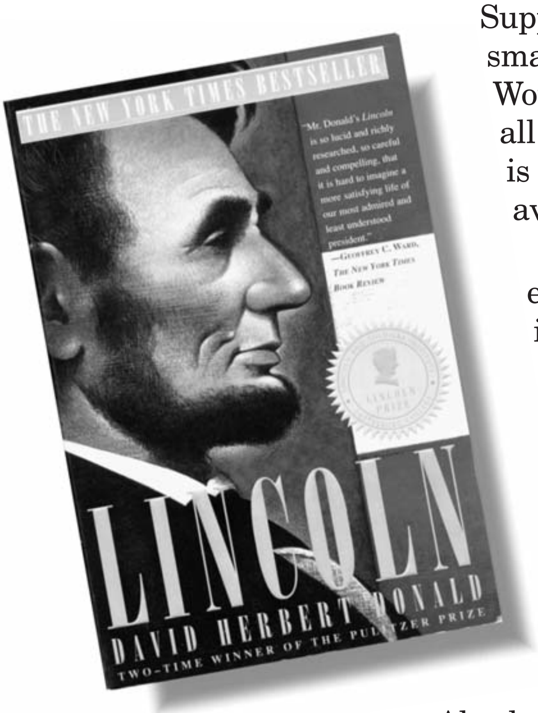


It seems that *Ercoupeman* based his opinion on anecdotal references without bothering to validate them. True, Ercoupes restrict elevator travel, which limits their ability to stall. But that doesn't mean they can't do something similar. We don't hear much about these things because the NTSB doesn't have an accident category for the event known as a *deep mush*.

The fact is, if we fly, we can't lie—to ourselves, that is. We have a stake in ensuring the accuracy of our opinions, which is why we should elevate them to the level of intellectual property. When earned and refined by rational thought and not carelessly borrowed or whimsically adopted, these opinions become tools for survival.

So how might pilots ensure the validity of their opinions? Perhaps the *Ventura Country Star* newspaper answered this question when it reviewed Steve Allen's book *But Seriously*.... Allen, a writer of more than 50 books and over 600 songs, has frequently impressed others with his keen intellect and sound judgment. It's no wonder the reviewer said, "Allen is a bonafide genius... [he] comes to his opinions through *careful study* and *flawless logic*." It seems that we are better off as aviators when following a similar strategy.

For instance, if you're a taildragger pilot, how did you form an opinion about the best way to handle crosswind landings? Did you carefully study the difference between wheel landings and three-point landings? If so, great. Did you consult *respected authorities* on the subject? If so, fantastic. After all, we need *experts* to help us decide these things. Suppose your opinion resulted from being exposed to a small number of crosswind landings in a taildragger. Would you now conclude that this opinion is valid for all taildraggers? Under all crosswind conditions? This is the trap that logical thinkers like Allen would avoid.



Al Einstein once suggested that a thousand experiments proving relativity right means nothing if a single experiment proves it wrong. Ensuring that our opinion accurately reflects an aviation truth obliges us to allow for the possibility it could be wrong. After all, if we believe that nothing can possibly disprove our opinion, then its validity becomes a matter of faith, not reason. Testing our conviction requires a willingness to look for evidence that disproves it. Only then can we confidently say that our opinion is based on fact, not fiction.

Abraham Lincoln used a similar method to validate his thinking when drafting the Emancipation Proclamation. Author David H. Donald, in his book *Lincoln*, states "... [Lincoln] played a kind of game with the numerous visitors who descended on him to urge him to free the slaves. The measures they advocated were precisely those that he was attempting to formulate.... If he challenged their arguments, he was, in effect, testing his own."

That's why the most important pilot you know is the one who believes something different than you. I've learned more meaningful things about aviation from those with whom I've disagreed than those who agreed with me. Like Lincoln, a challenging discussion helps us understand the strengths as well as the weaknesses of our opinions.

Yet we often debate to defend our positions, not to learn from our differences. In a sense, this is understandable. After all, what's at stake is a pilot's *ego*—a force just a tad more powerful than a 747's wing bolts. It can be a test of intellectual honesty to admit that our opinion on a particular topic may be wrong, especially when we've held it for some time or have proudly broadcast it to others.

Truth, however, becomes more significant than ego the moment we take our opinions seriously. Only then does humility follow. Now we're less inclined to be so sure of ourselves. We allow for the possibility that we may be wrong and, as a result, become more willing to recognize the frailties of our arguments.

Over the years I've learned to be wary of pilots who are too sure of themselves. Often (but not always), these are the opinionated folks who can rub an entire airport the wrong way with their stubborn certainty. And, contrary to what you might think, highly opinionated people *don't* take their beliefs seriously enough. They fail to make distinctions between opinions based on fact and on fiction. The only thing that's important to them is that they have an opinion.

Yes, it's natural for pilots to have opinions, even strong ones. It's unwise, however, to formulate them without careful and logical thought. So let's find others who'll intentionally play devil's advocate so that we may better know how tenable our position is on important aviation concepts. Let's also use caution when believing something only because someone else does. Finally, let's be wary of being too sure of ourselves.

In his book *Surely You're Joking, Mr. Feynman*, the late Noble Prize-winning physicist Richard Feynman reflects on asking a Japanese ambassador about the resiliency of his post-war culture. Feynman says, "The ambassador responded in a way I like to hear: 'I do not know,' he [the ambassador] said, 'I might suppose something but I don't know if it's true'."

Feynman expressed an obvious fondness for those who refuse to be overly sure themselves. But what would you expect from a mighty physicist in a profession that pursues truth? Feynman's humility allowed him to peer deeply into the mysteries of the subatomic world. Perhaps a similar attitude will help us better comprehend the world aloft.

A Foot in the Mind

Psychologist Robert Ornstein, in his book *Evolution of Consciousness: Origins of the Way We Think,* talks about a person he knew as Jim. Jim's reputation was based on his ability to get others to do things for him. Working for a San Francisco based church, Jim's talent proved useful in acquiring volunteers to help solicit funds for the poor. As a psychologist, Dr. Ornstein was curious about Jim's skill and spent considerable time observing him.

What was Jim's secret? He would have his minions give prospective volunteers five prestamped envelopes and letters. All the individual had to do was fold the letter, lick the envelope and put it in the mailbox. Most people easily complied with the request and many returned for more letters. Jim knew that small actions beget larger ones. Jim told Ornstein, "You know, once I get somebody, I can get them to do anything." The majority of a person's resistance is overcome with that first action. Jim used this to his advantage.

Dr. Ornstein found Jim and his method unnerving. Eventually, he ceased his study of Jim and his group. Several years passed before he heard about Jim again. This time, Jim was in the news. You'll probably recognize Jim by his full name, the Reverend Jim Jones of the Jonestown, Guyana, mass poisoning tragedy. There's a good chance that small actions—perhaps just the licking of envelopes—eventually led to the deaths of more than 1,000 people.

According to Dr. Ornstein, Jim Jones was crafty at getting *a foot in the mind* (a spin-off of the salesman getting a foot in the door). This peculiar quirk of the mind is visible in many ways, especially when it comes to spending money.

Have you noticed that it's easier to spend a lot of money once you spend the first few dollars? Few pilots walk into the pilot supply shop waving their credit cards while announcing, "Let the games begin." There is a natural reluctance to spend those first few dollars, especially where bigger sums are at stake. We like to browse, imagine and rationalize as we work up to that first purchase. While hovering over a new headset in the counter display, we listen to the devil of purchase on one shoulder and the angel of restraint on the other. Once we buy a few sectional charts, earplugs or a fuel dipper, things change. Now it's much easier to say, "Ah, what the heck, throw in that headset, too." A foot has entered your mind, and is resting on a slippery slope. It's all downhill from there.

It's a quirk of the mind (perhaps even one having an evolutionary value for survival) that a commitment to do a small thing breaks our initial resistance to doing more of it. In an airplane, this quirk can be deadly.

For instance, taking off into known poor weather to "have a look" may not be that much different from licking envelopes and mailing letters. Your verbal commitment is to return to the airport or make a 180 if the conditions are poor. This is, however, more difficult to do than to say. The moment those wheels leave the runway, you've taken the first step. A foot is in your mind. You've just spent your first few dollars. Returning to land is sure to be more difficult than it appears to be, for mental rather than mechanical reasons.

Weather isn't the only place we can fall victim to this mental trap. Starting a flight with limited fuel might be the first step to bypassing the first scheduled fuel stop. We might find it difficult to interrupt a flight begun while tired and fatigued.

Does this mean I would argue for never departing to have a peek at the weather when it's appropriate to do so, or never beginning a flight with less than full tanks? Not at all. We don't live in a perfect world and you only need to look at Don King's hairstyle to realize this. There's a law of physics that says an object in motion tends to stay in motion. That's true of psychological objects, as well. The secret here is to realize that the temptation to continue is greater once the game's afoot. Sometimes we just have to trust ourselves to do the right thing. Knowing that the right thing might be more difficult to do is certainly helpful in preparing us to behave properly when it's necessary to do so. A pilot with a high degree of inner knowing might minimize his or her vulnerability by acknowledging that the foot-in-the-mind risk is present with all first actions.

Pilots are unquestionably good at disciplining their mind. After all, it takes concentration to watch for traffic, navigate and communicate when flying in busy airspace. We are, nevertheless, pretty much like everyone else when it comes to acknowledging and understanding our psychological vulnerabilities, especially the vulnerability of having a foot in your mind. While this problem might less hazardous for a ground dweller, it's an important concern for an aviator.

Many years ago, the Chinese foot soldier Some Shoe…, no, wait, wrong guy. I mean the Chinese General Sun Tzu said, "Know the enemy and know yourself; in a hundred battles you will never be in peril." Knowing how easy it is to be influenced by small actions is the first step in avoiding being the victim of the psychological vulnerability known as having a foot in your mind.

It's Time to Speak Up

"Hey Rod, tomorrow I'm taking my little airplane out to see what it can do. I'll see ya later."

Those were the last words I ever heard my best friend speak. I never saw him again. The next day, his newly-assembled ultralight airplane disassembled in flight, for reasons suspected but officially unknown.

That tragic event occurred in December of 1984 and my friend's words are still clear. I've run that audio engram over and over, hundreds of times, each time reliving the same feeling I had when he last spoke. The memory provokes a peculiarly unsettling experience—as if my world is about to change and I must act immediately to stop it. I abhor that feeling, but I also respect it.

If only I had said, "Hey partner, wait! Something's not right here. Yes, your airplane has a ballistic parachute system. But can you trust it? You are nine years my senior. I defer to your experience and judgment. But listen to your words, 'See what my little airplane can do?' It sounds like unnecessary risks are involved. Convince me I'm wrong." I have no idea if those words would have prevented the loss of my friend. I wish, however, I had spoken them.

Those were the last words I ever heard my best friend speak.

Instead I quipped, "Hey buddy, have a great time." Those words, tossed away as easily as a crumpled gum wrapper, came from the wrong place inside my brain. It's a place that is overly concerned about what people think of me, a place reluctant to butt my nose into the business of others or butt heads with them. Given another opportunity, I'd attach a different part of my brain to my voice—a wiser part, the part within all of us that knows better than to keep quiet. I've since had that opportunity with a number of others.

It first happened a few months later, at an aviation expo. I overheard a young flight instructor regaling fellow pilots with a curious tale. He confessed with pride how he flew a Zlin—one without any working gyro instruments—to the expo in scudrunning weather conditions that morning. Indeed the weather was bad, very bad. That's why the craft I landed at the airport that day was a Chrysler, not a Cessna.

I was taught to mind my own business. After all, few people like another person's values imposed upon them. But where does his business become my business? No precise, well-defined border exists. Sometimes it's clear; sometimes it's not. In this case it was clear that a fellow pilot thumbed his nose at risk, perhaps unaware of the hidden dangers.

In aviation, the users are also the caretakers. Each of us shares a tacit responsibility for aviation's health, a responsibility that implies informing fellow aviators when we think their actions expose them and others to unacceptable levels of danger. On that basis, I decided to speak up. I approached him and said, "Excuse me but I'd like to tell you a little story about a dear friend of mine who's no longer with us...."

Speaking up has its risks. At the extreme, it's possible that an offended ruffian might say, "Hey. I'm going to punch your nose in." I suggest you avoid saying, "Don't you know you never end a sentence with a preposition?" After all, it's possible he may elect to punch in your nose.

While it's unlikely you'll ever receive impromptu rhinoplasty, the risk of offending someone by speaking up always exists. Yes, your actions have consequences. But so does inaction. Silence is not necessarily golden; it has consequence too.

Perhaps the words of the bright but mischievous radio personality, Bill Balance, are appropriate here. He once said, "I'd rather have remorse for what I did, than regret for what I didn't do." Applied in the context of aviation safety, it seems better to say, "I'm sorry I said that," rather than "I wish I had said that." In this small way, we fulfill our responsibility as pilots to help ensure the survival of aviation and its participants.

Since December of 1984, I've taken airplane keys away from a drunk pilot, and grounded a few airplanes that I thought presented an imminent danger to both pilot and passenger. I've even had a rather spirited discussion with the pilot of a Cherokee Six after eight people emerged (you do the math). Each time I hesitated before I acted and thought, "Is this really any of my business?" Then I heard those words, "Hey Rod, tomorrow I'm taking my little airplane out to see what it can do. I'll see ya later...."

The Don't-Panic Button

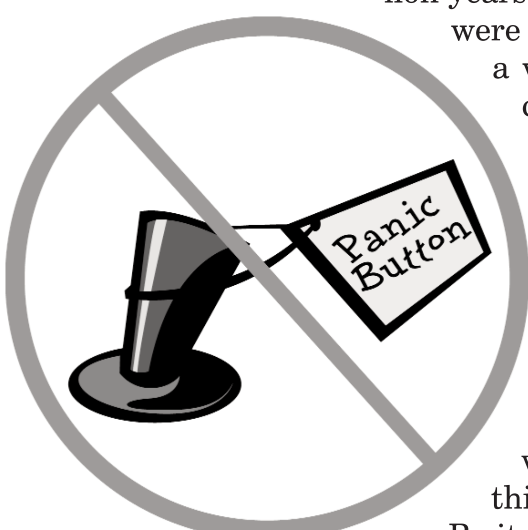
Can You Prevent Panic?

What's the most important thing people must do to survive life threatening situations? According to Doug Ritter, a well known and respected safety specialist, the best lifesaver is avoiding panic in emergency situations.

How true. Panic is the most disadvantageous reaction for survival in almost any serious situation. This is doubly true in an airplane. Panic is fight-or-flight personified. It's the loss of the rational intellect, where bodily chemicals (adrenaline) drive our biological engine in full afterburner for one purpose—escape.

As a terrestrial defense, a fight-or-flight response is at least potentially valuable. After all, if you're being chased by a bear (because it heard you keep a cub at home—a J-3 Cub, that is), you run. If you're faster than the predator, you live. Otherwise, you're lunch. This is the live-or-lunch response. In the cockpit, however, you can only hum a popular song that went "Nowhere to run, baby, nowhere to hide."

In the air, an escalating fight-or-flight response is a prelude to panic. It's almost always a deadly response, too, because panic is paralyzing, and doing nothing in most emergencies is usually not the response that will most enhance your survival chances. Fight-or-flight, though, is a genetically programmed instinct, the result of several million years during which the strategy worked. Who knew we were going to fly? So now you have to think (literally) of a way to outwit your genetic heritage. You need to create a don't-panic button.



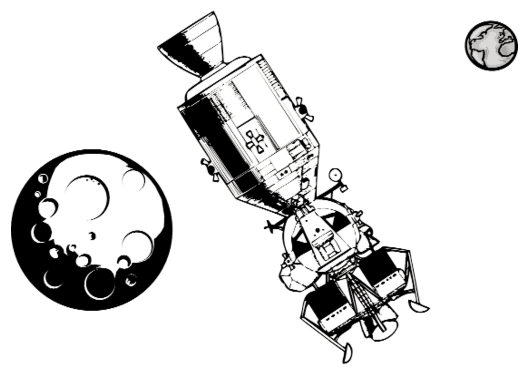
Preventing panic during in-flight emergency situations requires three things: having a plan, believing the plan, and practicing the plan enough so it becomes a habit.

Having a plan is important for two reasons. First, it gives you something to do besides panic. The plan is your don't-panic button, the go-to strategy when confronted with something wrong. It's a way of stuffing the fight-or-flight thing. Second, a plan tells you the *right* thing to do. Be it a single item to implement or an extensive checklist to follow, a plan is fundamental to handling in-flight emergencies. Without such a plan a relatively benign situation can turn into a deadly serious business. Without a plan, the urge to do *something* can lead to doing the wrong thing and making a bad situation worse instead of better.

A student pilot discovered this several years ago in the traffic pattern at Long Beach airport. On the downwind leg, the door of his Piper Warrior popped open. Having never planned for such an occurrence, he was unaware of the most fundamental, holy and sacrosanct of all door-popping rules—fly the airplane, not the door. To do otherwise is as risky as a pre-democracy jump over the Berlin Wall.

Without a plan, the student's mind was lost in an avalanche of emotions. "Grab the door, shut the door," was his primal response. Distracted by this singular thought, his airplane spiraled out of the pattern. A quick thinking controller (also a CFI) assessed the situation and instructed him to forget the door and fly the airplane. The outcome was airplane OK, door OK, student OK. Without a plan, there's little assurance that you'll be guided by your intellect rather than your emotions. And you might not be lucky enough to have a capable controller on hand in your moment of need.

No one can deny the value of a good plan, even one that's devised extemporaneously. Apollo 13 ("Houston, we have a problem") command pilot James Lovell knew this quite well. Two days into the lunar landing mission, an oxygen tank ruptured, crippling two of three oxygen fuel cells. Left with only one drained cell, Lovell, his crew and Mission Control had about 15 minutes to devise a plan.



With the ebb of life support in the command module, they decided to power up Aquarius—the Lunar Excursion Module (LEM)—and spent the next four days riding home in this life-supporting cosmic condo. This gave new meaning to it being the Age of Aquarius. Nearing Earth, they jettisoned the LEM and returned to the command module for protection against the fiery reabsorption into the atmosphere. Lovell, Swigert and Haise survived because of a good plan. Had they yielded to the panic option, their chances of survival would have been about zero and none.

We airplane pilots (on a less stellar scale) need similar plans to cope with in-flight emergencies and avoid panic. Unlike the situation of the three heroic astronauts, we probably won't have the luxury of time to devise a plan on the spot, nor the assistance of a roomful of NASA scientists to help. This is a do-it-yourself project.

Like a hungry baby, an airplane with a failed or faltering engine demands immediate attention. If you don't have a plan, you probably won't have time to devise one. A preformulated, step-by-step procedure is your ticket to safety. If you ever find yourself in such a situation, at least do the following three things: pull your carburetor heat (or alternate air), switch fuel tanks, and turn on your electric fuel pump (if you have one—if you don't have one, this is not the moment to install one). Don't ever forget this. As simple as it sounds, this little plan solves more than 95% of all engine failure problems.

But what about other serious in-flight problems? Fortunately, prepackaged plans for such emergencies are found in the checklists of most pilot operating handbooks (POH).

Handling in-flight fires, dealing with engine malfunctions, coping with electrical problems are but a few of the delineated emergency procedures you'll find in your POH. Your job is to familiarize yourself with every one of them. By familiarize, I don't mean to simply know where to find the emergency checklist in the handbook. Some of these emergency procedures must be memorized. Think of this study as your *Tao of POH*. When you need the information, there isn't time to launch a read-a-book-a-month program.

Instant recall of the most crucial emergency items is mandatory. Have this knowledge stored in RAM (random access memory) before every flight. After all, if a trained martial artist is attacked, he doesn't pull out his "How to kick someone's empennage" checklist during a fight, does he? Of course not. He responds reflexively. Time-critical emergency items must be memorized. Things that are less time sensitive—landing with a flat main tire, ammeter showing insufficient rate of charge, emergency descent through clouds, etc.—can be handled to the cadence of a written checklist.

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A plan is only the first step in panic prevention. You must believe in the plan you're working. Without this, the foundation of confidence in your plan cracks like icebergs calving on hot days.

Perhaps you've experienced something similar when flying with a trusted flight instructor. Deep down inside, you know this person wouldn't expose you to danger. You willingly do stalls and spins with only normal apprehension. But what if you didn't trust your CFI? You certainly wouldn't feel that he or she would keep you safe, would you? You'd be less likely to follow their instruction without feeling great anxiety. If you don't believe in your plan, you're less likely to follow it during an emergency. This is another prelude to panic.

There is only one way to gain confidence in the emergency plans and procedures you implement. You must understand the reasons behind them. During one in-flight training session, I was having trouble convincing a student to turn off the master switch during the simulation of an in-flight engine fire. He reasoned it was better to keep it on so he could make continued emergency transmissions. (I also find that many students think the master switch is what makes the propeller go around, and that turning it off will *cause* an in-flight emergency.)

He didn't know that in this model Cessna 172, the avionics cooling fans inhale air from along the front side of the fuselage to cool the radios. With the master switch in the "ON" position, smoke as well as air, could easily be drawn into the cockpit. Instead of calling for help, the pilot would be blowing smoke. Once he understood the reasoning behind the action, he willingly complied with my request and turned off the switch (besides, he didn't need a radio to communicate with the person he really wanted to talk to).

People do things for a reason. The more meaningful the reason, the more likely the person is to act properly. To develop confidence and a belief in your plan, try to understand the reason behind every aspect of it. Examine your checklists in detail. If you don't understand why it's done a particular way, find out. This knowledge is the glue that strengthens our commitment to acting rationally in an emergency.

Having a plan and believing in it doesn't confer perfect immunity against panic. Your response to an emergency situation must be subconsciously driven. It must be reflexive. Take the trained martial artist, for instance. Anywhere from three to six years of practice is necessary to achieve the rank of black belt. In that time, thousands of punches, kicks and blocks are exchanged with a training partner. Through constant repetition, a valuable, defensive reflex develops.

At this point, martial artists don't just think of using karate to protect themselves; they *are* karate. The reflex is part of them, not something they think first and then do. They block, kick and punch as easily as you might throw out your hands in protection from a fall. This is the purpose of reflexive training. In an in-flight emergency, this degree of black-belt type preparation is your ticket to preventing the panic response.

For instance, during cruise flight, an in-flight engine fire demands immediate action. You must act immediately, if not sooner. There is no time to think. Your first action is usually to reduce power, shut off all fuel to the engine, turn off the master switch (if appropriate), speed up to extinguish the fire and get this airplane out of the sky in the quickest and safest manner. You must act reflexively. You must act now! This is no time to search for and begin reading the engine fire checklist.

In his book *Psycho Ceramics for Crackpots*…no wait, that's *Psychocybernetics*, Maxwell Maltz once said it takes 21 days to make a behavior a habit. While it's hard to quantify the time it takes to make a cockpit emergency response a habit, it certainly takes practice. At least enough practice that you feel you'll respond properly in an emergency. Remember, If your behavior isn't a reflex, then you don't own it. It's not part of you. Chances are, in an emergency, you won't respond appropriately. Thus, you are one step closer to the primitive fight-or-flight panic response.

Mother Nature provided us with two getaway sticks (legs) for use in an emergency. While millions of years of genetic honing reinforce their use, they are of little value in an airplane. Survival means acting contrary to our instinctual response to run. Knowing what to do, believing it's the proper thing to do, and having the reflex to do it, keeps us master of our emotions. Start installing your don't-panic button today.

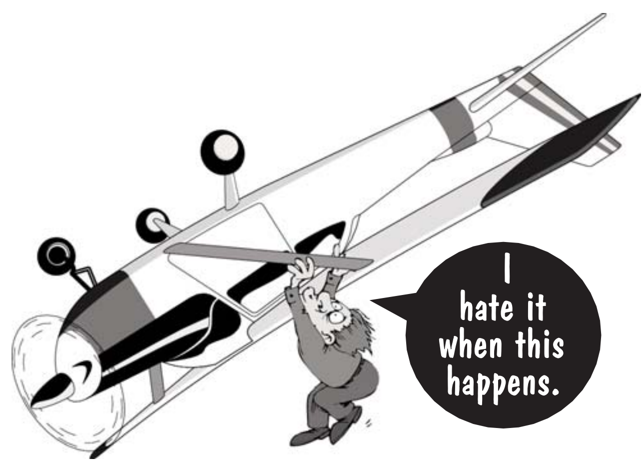
May the G-force Not Be With You

Should Turbulence Scare You?

Cruising at 7,500 feet enroute to Los Angeles in a Cessna 210, my student and I were anesthetized by silky smooth air. Clear skies and a favorable forecast assured a calm and comfortable flight, or so we thought. Without warning, without anticipation, we were ambushed. From out of nowhere, we took a flank jab to the aileron, an uppercut to the spinner, and a kick to our empennage. It was atmospheric turbulence at its worst. While short in duration, this aeronautical alchemy churned adrenal chemicals in both of our bodies.

Stunned and shaken, my student looked to the left, then to the right, then nodded his head, apparently pleased that the wings were still attached (as if he wouldn't have known had it been otherwise). Of course, I was checking them, too. We eventually agreed that he'd keep an eye on the left wing and I'd assume responsibility for the right one and we'd immediately report to each other if one were missing.

Yes, turbulence is scary. Even experienced pilots fess up that they never quite get used to it. But experience teaches one that turbulence is usually more stressful on the pilot (and passengers) than it is on the airframe.



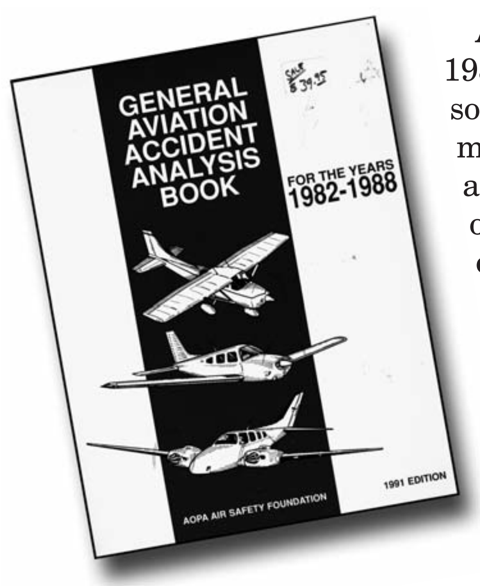
I constantly marvel at the human reaction to in-flight turbulence on airliners. People scream, people cry, people pray. And that's just in the cockpit. Simply stated, we don't like turbulence because it's unpredictable. Without knowing how bad it might get, our imaginative, scenario-spinning mind projects frightening, highly improbable outcomes.

Many students, for instance, easily imagine an airplane turning upside down in strong turbulence. There is good reason for us to feel this way. Built into our genetic makeup is a primal dislike of teetering or falling. Toppling from trees might have generated two opposable thumbs-up for amusement from our Australopithecus brothers and sisters, but it's doubtful the drop had much survival value. Our instinct is to prevent falling. It's no wonder we react reflexively, as if falling, when airplanes are jolted into a bank.

Fortunately, our fears are usually unwarranted. In all my years of flying I have never had an airplane turn upside down in clear air turbulence (CAT), nor in convective (cumulus cloud-type) turbulence. Now, I'm not saying that this can't happen, but I've never had it happen to me. It's just simply a very rare phenomenon. Of course, I've had students accidentally try to turn us upside down, but Mother Nature played no part. The closest I've come from natural causes was an approximate 60 degree bank jolt. Recovery was easy. I simply used aileron and rudder to roll the airplane level.

Pilots occasionally report airplanes being flipped "flapjack" onto their back. But most of these pilots were flying in severe mountain wave turbulence at altitudes where the winds were way over 25 knots. These situations are extremely rare, and almost always predictable and avoidable. Don't fly near mountains when there are high winds forecast. Duh. Nevertheless, knowing how to roll an airplane upright from the inverted position is a handy skill to have. You'll probably never need this knowledge, but knowing it's there offers great comfort.

Students are often concerned with turbulence-induced airframe damage. They wonder, "Will the wings crack off in strong turbulence?" If you think this way, you're not alone. Experienced pilots ponder similar questions. Your worry, however, is almost certainly way out of proportion to the reality, a structural bogeyman you should exorcise using the information I'm about to provide.



An analysis of general aviation accidents from 1982 to 1988, complied by AOPA, shows clear air turbulence to be something other than the mustache-twirling villain it's made out to be. Out of 16,220 fixed wing general aviation accidents, a grand total of two aircraft lost control and overstressed the airframe in clear air turbulence. And only one of these accidents resulted in fatalities.

Considering the millions of hours flown during this six year period, this statistic says a lot about the strength of airplanes. Simply stated, CAT properly handled is very unlikely to damage your airplane.

Let me explain why airplanes are so clamshell tough and not easily damaged. Part 23 of the FARs sets certification standards for aircraft design. One requirement is for airplanes to withstand a G force of at least 3.8 G's for normal category and 4.4 for utility category airplanes. This is known as the airplane's *limit load factor*. One G is the gravitational force you feel while at rest on the ground, or when your airplane isn't jumping around like a rambunctious first grader.

Airplane wings, stressed to the limit load factor and not beyond, shouldn't exceed their elastic limit. In other words, under this load the wings will flex. Once the load is removed, they will return undamaged to their previous shape. This is a good thing. After all, if you take an airplane flying, it should be returned with its wings in the same shape they were before you left (yes, even if it is a rental).

Imagine how strong the wings must be to withstand this limit load factor. If a fully loaded Cessna 172 weighs 2,550 pounds, its wings must withstand a force of 11,220 pounds (4.4 x 2,550) in the utility category without being damaged. In other words, sixty-six 170-pound, FAA-standard men could be placed on the wings of this airplane (33 on each side) without damaging the airfoil structure. Of course, they would be placed to apply force in the positive-G direction (i.e., force applied in an upward direction). Whatever you do, don't try this at home. Just take my word for it. At least you can imagine just how strong those wings are.

Do Not Try This at Home!

Many years ago, I sent a student pilot on a solo cross county flight to Palm Springs. Several large mountains—aviation's biggest troublemakers—form the perimeter of the route to this desert airport. Given enough wind, these mountains often produce sheets of churning, bubbling air.

That day was forecast clear and smooth (ha!). My student departed, only to return four hours later, his face flushed free of all blood, color, and apparent life. He waved me over and told his tale. "It was the worst turbulence I've ever seen," he blurted. "It was so bad I thought I saw the Buddha."

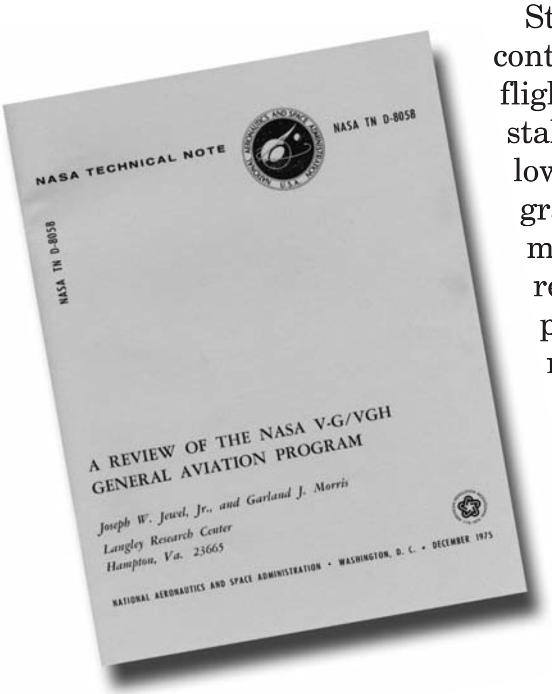
Since he was in a Cessna 150 Aerobat (it had a G meter), I walked him over to the cockpit. We looked inside at the G meter (which stays pegged at the highest G-force encountered, until reset). I pointed to the instrument. It read 1.7 G's. I said, "You only pulled .7 more G's than you feel in straight-and-level, unaccelerated flight. In fact, you experience more G's (2 to be exact) in a 60 degree steep bank turn."

He looked puzzled, liked a baker who had never heard of yeast. I was waiting for him to admit that he really saw his friend Bubba, not the Buddha. In then end, he was simply amazed that the shellacking he took never exceeded even one-third of the airplane's limit load factor (aerobatic aircraft have a limit load factor of 6 G's positive). In other words, he was in a 6G airplane with a 1.7G triggered imagination. If anything, this should reinforce the point that it's not the G force that scares pilots, it's the unpredictability of the event.

On the other hand, how likely is the average airplane to reach or exceed this G force limit? On a rare occasion, it happens. When and where it happens is no real surprise.

A NASA study on gusts and maneuvering loads found that exceeding an airplane's limit load factor as a result of pilot-applied control inputs was primarily to the province of aerobatic flight, aerial applications, and instructional operations.

It's no surprise that an aerobatic pilot, confined to a designated cube of airspace, might yank and bank to keep the airplane within that cube. Aerial applicators are similarly self-restricted by the size of the field they're dusting. Both operations can lead to high load factors as pilots maneuver to remain within these self-imposed zones.



Students are no less likely to be rough on the flight controls, which is the primary reason instructional flights experience excessive load factors. Once, during stall practice, I told my student to lower the nose. He lowered it by shoving the control stick full forward. I grabbed a pencil off the roof and made a note to use more adjectives the next time I discussed stall recovery. Fortunately, we were way below the airplane's maneuvering speed (I'll discuss this next), resulting in a relatively small negative load on the airplane.

This same NASA study concluded that commercial survey operations (e.g., forest and pipeline patrol airplanes) were most likely to experience turbulence or gust-induced forces outside the design flight envelope. This isn't surprising, because these folks constantly fly from 50 to 1,500 feet above the surface where mechanical turbulence is greatest.

Here's how I interpret all this. First, the loads imposed by aerobatic flight, aerial applications, and instructional operations are controlled by their respective pilots. So, be gentle with those controls. Mother Nature, however, is primarily responsible for the loads imposed on commercial survey operations. For these folks, it's best to avoid flying close to the surface when excessive mechanical turbulence is present.

Airplanes *can* exceed their design limit loads, but it's almost always the result of something the pilot did or didn't do. Mother Nature is seldom *directly* responsible for the act.

To prevent exceeding the airplane's limit load factor, you must know and make use of the maneuvering speed. Known as Va, maneuvering speed is the speed at which the airplane will stall before the limit load factor is exceeded. In other words, if you are at or below the maneuvering speed, a sudden, instantaneous increase in angle of attack (as experienced in a severe gust) will stall the airplane before the limit load factor is exceeded. It's a self-limiting limit, because once the plane stalls, the excessive force is unloaded. The nose goes down before the wings come off. How convenient.

You would doubtlessly agree that it's better to have an airplane stall than damage or lose its wings. Stall recovery is easy; broken wing recovery isn't. Only one book need be consulted if a wing breaks, and it comes in both old and new testaments.

It's a misconception that maneuvering speed is the best airspeed value to use when flying in turbulence. I recommend that you fly 10 to 15 knots *below* maneuvering speed. Since maneuvering speed in an indicated airspeed, any horizontal gust could temporarily raise the IAS above Va, and thus subject the airplane to excessive stress. Staying slightly below maneuvering speed makes it less likely that the IAS will rise above this value when a sudden gust hits.

Remember, maneuvering speed varies with weight. As the weight decreases, Va *decreases*. This is counterintuitive for some pilots, who associate being lighter with being faster. In this case, a lighter plane is subject to a sharper push (i.e., will experience more G's) for the same amount of applied gust, so its maneuvering speed must be lower to achieve the same protection. If you walk up to an NFL tackle and apply a push, then do the same thing to a ballerina, which one is likely to have their position change more sharply? The fact that maneuvering speed varies with aircraft weight is why Va is not color coded or marked on the airspeed indicator, as are other speeds. Most pilot operating handbooks provide the correct maneuvering speeds for different gross weights.

It's a misconception that maneuvering speed is the best airspeed value to use when flying in turbulence.

Prepared pilots always know the power setting required to give them flight at or below maneuvering speed at a given weight. You don't have to be overly precise about this. For most general aviation airplanes, having a "light, medium, full" set of settings in mind is probably sufficient. The moment you suspect or encounter turbulence, immediately reduce power (if necessary) to slow the airplane below the Va for your current weight. Now it's just a matter of riding out the turbulence and maintaining control without overstressing the airplane.

Of course, this often easier said than done. Your best bet when ambushed by turbulence is to fly attitude. In other words, don't attempt to hold altitude at the cost of overstressing the airframe. Let the airplane move vertically with the waves of air. Think of it as air surfing without the fear of being bitten by a crab. Return to your target altitude when it's possible to do so without overstressing the airplane. Find comfort in knowing that, when flown below Va, it's almost impossible to overstress an airplane in clear air turbulence.

While it may be a *safe* ride, nobody says this will be a *comfortable* ride. And no one says your passengers are going to like it, either. If you're smart (as I know you are because you're reading this book), you'll tell your passengers about the realities of turbulence before takeoff. The "don't ask, don't tell" philosophy works semi-OK in the military, but given that you're a civilian and we're referring to turbulence, please tell! Keep in mind that your passengers do not have the benefit of controlling the airplane themselves, they're not schooled (as you now are) in the nuances of turbulence aerodynamics, and they have no way of even guessing when the wings will fall off. This is why the slightest bump is often enough to curl passengers' toes 180 degrees. Be a good pilot and a good friend. Tell your passengers what turbulence can and cannot do, assure them you understand that it's uncomfortable and want to assure them it's not unsafe. Let them read this article. An informed passenger is a quiet passenger. Tell them that as long as you are still in the airplane, everything's fine and turbulence has not reached a remotely threatening level. Of course, if you leave, they should immediately follow.

A friend of mine used to fly a small tour planes around the Grand Canyon. Some of the nastiest turbulence can be found in these earthly gouges. He had a junior copilot and two German tourists on board one day when chaos in the sky broke loose. Flipping, churning and rolling, the airplane bounced like a Dixie Cup in a wind storm. Finally disgorged by this air spasm, he recovered with the airplane pointed 180 degrees from the original heading and about a half mile off course. It was a rough ride, but the airplane was definitely in one piece.

The turbulence was so intense that the copilot had apparently bitten clear through his filter tip cigarette (yep, he was smoking at the time, to relieve stress, I bet). My friend glanced at the back of the airplane, expecting to see two stunned tourists. Instead, both fellows sprouted big grins, slapped their knees and said, "Yah, yah, dat vas gooot! Dat vas gooot! Do it again! Yah! Yah!" They must have thought it was part of the tour. Imagine how disappointed they'll be when they return next year with their friends and wait for the mid-trip lomchavok.

It's very important that you differentiate between the airframe structural perils of clear air turbulence and those associated with flying in IMC (instrument meteorological conditions) in or near adverse weather (primarily thunderstorms). Clear air turbulence is just that, turbulence associated with clear air. Properly handled, it's more scary than it is a serious threat to the airplane structure. Flying in IMC in or near adverse weather is a bump of a different grind.

Out of the 16,220 accidents during the six year period covered by the AOPA study cited earlier, 32 exceeded the airplane's design limits while flying in or near adverse weather. Forty-one additional accidents occurred when the airplane exceeded its design limits while the pilots attempted to fly VFR in IMC with limited instrument experience. *Every one of these accidents involved fatalities*. What does the data mean? It tells me that turbulence isn't the enemy, even in IMC.

The reasons airplanes come apart in IMC is because pilots lose control of their machine. Ice may be the culprit and instrument failures may also be culpable. But more often than not, pilots are simply overwhelmed by vertigo, especially when they have little or no instrument experience. It doesn't take long before the airplane shoots out the bottom of the clouds at excessive speeds, with wings, control surfaces and ancillary parts close in trail.

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Speed is the enemy here, not turbulence. Too much speed and airfoils twist themselves off the airframe. At these velocities, airplanes are subject to the perils of flutter and dynamic divergence. Neither of which you ever want to experience, even if you're getting test pilot pay. Inoculation against airframe failure demands that you control your airspeed, preferably keeping it at or below Va.

One of the very best remedies for turbulence-induced anxiety is to fly an airplane with a G meter. Few pilots ever have the chance to calibrate their estimates of turbulence with reality. If you own an airplane, a G meter will be the best (under $200) investment you make. As an alternative, go up in an aerobatic plane equipped with a G meter and see (and feel) what 2 or 3 G's really is.

Should turbulence scare you? Yes. Quite frankly, there is nothing wrong with a little fear. But your fear should be of what *you* do or don't do, not of the turbulence itself. The evidence tells us that pilots can be very much in control of how safe they are when confronted with turbulence. Should you worry that it will send the airplane to ground in assorted pieces? Absolutely not, as long as you maintain control of your airspeed, use your knowledge of Va, and keep the shiny side up. Pilot failure, not structural failure, is the real risk of getting all shook up.

Rod Machado's Plane Talk
The Mental Art of Flying an Airplane
You'll Learn, You'll Laugh, You'll Remember!

Welcome to a collection of Rod Machado's most popular aviation articles and stories from the last 15 years. *Rod Machado's Plane Talk* contains nearly 100 flights of fun and knowledge that will stimulate your aviation brain and tickle your funny bone. In addition to the educational topics listed below, you'll read about higher learning, the value of aviation history, aviation literature, aviation art and how an artist's perspective can help you better understand weather. You'll also find more than a few articles written just to make you laugh.

In this book you'll discover...

How to Assess and Manage Aviation Risks
Learn how safe pilots think, how to apply the safety strategy used by General Jimmy Doolittle (known as the master of the calculated risk), how famed gunfighter Wyatt Earp can help you cope with aviation's risks, how misleading aviation statistics can be and why flying isn't as dangerous as some folks say it is.

Several Techniques for Making Better Cockpit Decisions
Discover how to use your inner copilot in the cockpit and the value of one good question asked upside down.

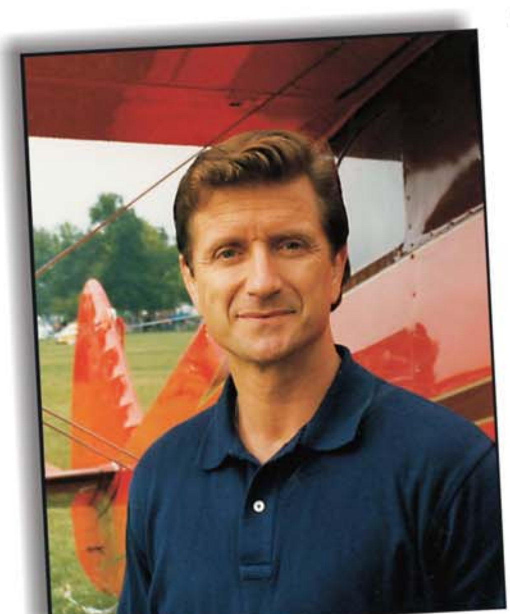
New Ways to Help You Cope With Temptation
Fly safer by developing an aviation code of ethics, understand how human nature can trick you into flying beyond your limits, why good pilots are prejudiced and how a concept like honor will protect you while aloft.

How to Use Your Brain for a Change
You can learn faster by understanding how the learning curve—the brain's performance chart—is affected by the little lies we tell ourselves, the mistakes we need to make, our need to please our instructors, and simulator and memory training.

The Truth About Flying, Anxiety and Fear
Learn why it's often the safest of pilots that make excuses instead of flights, why anxiety should be treated as a normal part of flying, and a three-step process to avoiding panic in the cockpit.

How to Handle First Time Flyers and Anxious Passengers
Discover how to behave around new passengers, how to avoid most common mistakes that scare passengers in airplanes and how to reduce the cockpit stress between pilot and spouse.

Favorite Skills Used By Good Pilots
Learn why good pilots scan behind an airplane as well as ahead of it, are sometimes rough and bully-like on the flight controls, occasionally fly without using any of the airplane's electronic navigation equipment, don't worry about turbulence breaking their airplanes, master airspeed control as a means of making better landings and much more.



Your Author

Rod Machado is a professional speaker, educator, humorist and a highly experienced pilot. With degrees in aviation science and psychology, Rod spends much of his time traveling the country presenting seminars on a variety of aviation subjects. You may have seen him on one of his *Wide World of Flying* video segments or read his articles in *AOPA Pilot* and *Flight Training Magazine*. Rod began flying in 1970. He has over 8,000 hours of teaching experience in airplanes, an Airline Transport Pilot's license and a pocketful of flight instructor ratings. Rod loves nothing better than to fly or talk about flying.

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