What Flying Taught Me About Recording #24

I'm Doug Fearn and this is My Take On Music Recording

What has flying airplanes taught me about recording music? Well, honestly, not much that is directly applicable to recording. But there are many things I learned from flying that helped me in a more general way when it came to not only recording, but also in the design and manufacture of pro audio products. And a life in audio has helped me in flying, too.

Let me explain.

I'll start with a contrast between high quality studio audio and aircraft communications audio.

Aircraft pilots need to communicate while flying. This is obvious when dealing with Air Traffic Control, the FAA network of control facilities that keep airplanes from running into each other, as well as expediting the flow of traffic at busy airports.

But most airports in the world do not have a control tower. Lacking someone who is keeping track of where you are and what you are doing, the job of coordinating safe flight in the vicinity of the airport is left to the pilots. This is accomplished by using standardized procedures when taking off and landing, and announcing on the radio where you are and what you are doing.

Of course, you also have to look out the windows and see where any other airplanes are, and which direction they are going, if you can see them. But by making announcements at standardized points in the traffic pattern around an airport, everyone should be able to sequence themselves into the traffic flow and maintain a safe distance apart. This works very well.

This communication requires a radio transmitter and receiver in the airplane, and assigned frequencies for the airport. The radios used are purposely audio bandwidth-limited to just the voice range – about 300 to 3000 Hertz. No exactly hi-fi, but this range was determined over 100 years ago by Bell Labs and others to be the minimum necessary not only for good intelligibility, but also good enough that a particular voice can be recognized.

Airplane cockpits are a very noisy environment. A typical general aviation airplane, like my Piper Dakota, a 4-seat, single-engine model, have a noise level in cruise of about 95dB SPL. That's plenty enough to cause permanent hearing damage with even short exposure. To help make radio transmissions from that noisy environment work, the microphones used are worked very close – resting right on the pilot's lips. And they are actually two microphones in one. One is right at the pilot's mouth and the other is aimed away from the pilot, but in very close proximity. The two microphone outputs are combined out-of-phase so that any sound picked up by both mics is cancelled out. But the pilot's voice is directed into only one of the mics, and hence not cancelled. The result is a significant drop in background noise level, sometimes to the point where it is difficult to tell that the pilot is actually transmitting from inside a moving airplane.

This noise-cancelling technique is used occasionally in the studio, particularly when recording a vocal live with a loud band. It is not as hi-fi as an isolated vocal mic, but it does solve a problem.

That high noise level inside an airplane meant that I could not tolerate the assault on my ears. As a kid, I was invited on a flight with a family friend who had a Beachcraft Bonanza, which was sort of the Mercedes of small airplanes. I was very excited about going. I have always loved being up high and seeing for great distances, and getting a different perspective on the world. I think they had to practically drag me off the observation deck of the Empire State Building when I was seven.

That first flight was thrilling. Rushing down the runway and then, lifting off from the earth and watching the ground drop away was like magic to me. I have to say, 60 years later, I still feel the same awe.

But the noise was horrible. I could not truly enjoy the flight because the sound was so painful and distracting to me. I would have loved to learned how to fly, but not if it meant tolerating that noise. You could not even have a conversation.

Fast forward about 20 years. I went to an airshow at a small airport near where I live. It was wonderful to see all the airplanes doing aerobatics, and World War 2 aircraft flying low overhead. They were offering airplane rides, but I passed that up because of the noise.

The next year I did go for a flight at the air show, in a 1930s Tiger Moth open cockpit bi-plane. I brought along ear plugs, and that made the experience much better.

Back on the ground, I talked with a young pilot who was an instructor at the flight school at the airport, and when I told him that I could not tolerate the noise, he explained that their training airplanes all had headsets that blocked out the noise, and also provided an intercom so that everyone on the flight could talk to each other.

That sounded like a great idea, and a few days later I walked into the office of the flight school and said I wanted to learn how to fly.

That was a long time ago, when headsets like that were still a novelty in small airplanes. The noise attenuation was only about 20 to 25 dB, but it was enough to make the flying environment tolerable. Today, with noise cancelling headsets, the noise reduction is even better, and flying is practically quiet – it's a lower level at your ears than driving a car on the highway, even with the car windows closed.

From the very first flying lesson, the student is in control of the airplane most of the time. All airplanes have dual controls, so the airplane can be flown from either the left (pilot) or right (co-pilot) seat. The student sits in the left seat and the instructor is in the right seat, ready to intercede if anything dangerous develops, or to demonstrate how to do something.

And dealing with that dangerous component is part of every lesson. Flying is remarkably safe because of the training. If automobile drivers were taught the same way, there would be far fewer traffic accidents. And even after a pilot is licensed, he or she must still fly with a certified instructor periodically to evaluate the pilot's skills. And pilots must log a minimum number of take-offs and landings, day and night, to legally fly with passengers.

Most student pilots take anywhere from 20 to 50 hours of instruction before they are permitted to make a simple solo flight. The training continues after that solo flight, but the student can fly an airplane on his or her own, to practice for the test to obtain their Private Pilot's license. This solo practice flying will include demonstrating the ability to travel to a distant airport and back, landing at an airport with a control tower, and using electronic navigation equipment, among other things. With an instructor, the student will be taught the rudiments of flying using the panel instruments, without being able to see outside. This is a safety thing.

After passing their checkride with an FAA examiner, and passing a written test, the new pilot is certified to take passengers along, and fly anywhere he or she wants to go. Many pilots also work toward more advanced ratings, particularly if they are planning a career in aviation. The most important one is an instrument rating, which allows the pilot to fly in weather where the orientation of the airplane cannot be determined by sight. Only the instruments provide information on whether the airplane is turning, climbing, or descending, and on-course. It is said that a non-instrument rated pilot typically will survive for only a few minutes in the clouds before losing control of the airplane and crashing.

I went directly into working on the Instrument rating without a break. I knew that if I wanted safety and utility from an airplane, that rating was essential.

If getting a Private Pilot's license is all about learning how to make the airplane do what you want it to do, the Instrument rating is much more about interpreting what the dials and gauges in front of you are telling you about the flight at any instant. A lot of my previous experience before learning to fly was with interpreting what various indicators told me, whether it was a VU meter, a red record light, test equipment indications, or, these days, all that and a waveform on a computer screen. Learning how to interpret the altimeter, airspeed indicator, attitude indicator, and others was easy for me. In that regard, my audio experience helped me to learn how to master instrument flying.

During just about every flying lesson, or required flight review, at some point the instructor or examiner will reach over and kill the engine and watch what you do. Airplanes are incredibly reliable machines, but things can go wrong. Most of what goes wrong is from lousy maintenance. Small airplanes use air-cooled piston engines, but they are quite different from car engines. For one thing, an airplane engine is asked to provide 100% power for takeoff and climb. And a climb to a cruising altitude could require 20 minutes. It's like pushing the accelerator pedal to the floor in your car and holding it there for 20 minutes. That car engine would not last long – maybe not even 20 minutes – but airplane engines have to be designed to do this every flight.

For reliability, small airplanes use magneto ignition, like you would find on your lawnmower. It's 100-plus year-old technology, but it has the advantage of not requiring a source of electricity. Once started, you can remove the battery from an airplane and the engine will keep running just fine. You won't have other electrically-powered equipment, but the engine will get you back to an airport. And the ignition system uses two separate magnetos and two sparkplugs per cylinder, so if one magneto fails, the engine will continue to run on the remaining one.

Backup systems are what make an airplane safe. And the same principles can be applied to a recording session. For a one-shot performance type of session, I will always have two separate recorders running, and a backup set of mics feeding the separate recorder.

On an airplane, the flight instruments are designed so that if one fails, there are others that can provide sufficient information to fly safely. The information will not be as easy to interpret, but it's there if you are trained to use it.

The electronics on an airplane need to be as simple and as intuitive as possible. Being distracted by trying to figure out how to make a fancy navigation system work while flying the airplane in challenging conditions is never good. Avionics ergonomics are important, and, for the most part, the designers do a good job. But space in an airplane cockpit is precious territory, so the equipment has to be made as compact as possible. And weight is always a consideration. The cumulative weight of the equipment may limit the number of passengers, or the amount of fuel, that can be carried.

And the equipment has to be reliable. A failure could create a dangerous situation, so everything has to work well all the time, for many years

Fortunately for me, the studio space environment is not quite as limited, but still a consideration. When I design a piece of equipment, I want it to be easy to use, with minimal thought. And just like avionics that is designed to prevent you from doing something dangerous, my equipment is designed so you have to really work to make it sound bad.

I also design for reliability. Sure, a mic preamp failure is not going to be a life-threatening event, but it certainly is bad. So, I design my products to be as reliable as possible – as reliable as avionics.

For the first couple of years of production of my products, I had the front panels painted at the airport paint shop. They did a great job. And with all my custom parts suppliers, I always try to show them the finished product that their work contributes to. The people at the airport shop were appalled at how big and heavy my products were – although they loved the look of them. They kidded me that I should never design anything for an airplane, and I think they are right.

But back to our simulated engine failure. An airplane without power is not going to fall from the sky. Even a helicopter has emergency procedures to get safely down to earth. An airplane can glide for a considerable distance, which, of course, increases the higher you are flying. A conservative rule of thumb is that you can glide for one mile for every thousand feet you are above the ground. You might not make it to an airport, but there will probably be a safe place to land the airplane in much of the world. A pilot will be tested for this over and over. Rarely does it mean you will actually land in a farmer's field, but you will be trained to locate and set up for that eventuality. At a few hundred feet above the ground, the instructor will restore engine power and you will climb back up to a safe altitude.

There are some places that I am uncomfortable flying over, due to the lack of a safe emergency landing spot. Cities, mountains, and water are examples of challenging locations to put an airplane down safely. But when you fly, you soon see that most of the U.S. has many suitable landing places. A lot of our country is farmland.

In my several thousand hours of flying, I have never had an engine emergency that required an off-airport landing, and most pilots will fly for a lifetime without an emergency like that. But we all train for it. And throughout the flight, good pilots will remain situationally aware and ready to set up for an emergency landing.

General aviation flying is not as safe as flying on an airliner, for several reasons. For one thing, all airliners have two pilots, which can be vital in an emergency. They use at least two engines, usually turbine engines, which are more dependable than piston engines. And airline pilots are constantly being tested, usually in a very realistic simulator, while an instructor throws one emergency after another at them.

Even so, the accident rate is very low in general aviation. Statistically, you would have to fly for about 100,000 hours before you would be involved in a life-threatening accident. Even professional pilots who might fly for 50 years rarely retire with more than about 25,000 hours of flying time.

By comparison, however, recording is infinitely safer. Unless you do something stupid with electricity, your chances of harm in the studio are very low.

The only time I was faced with a life-threatening situation in a recording session was when a crazy producer aimed a gun at me and the keyboard player who was doing some overdubs. I was working on a project and wanted to use the very talented keyboard player for an overdub. I asked the producer if that would be OK, and he agreed after some reluctance. The keyboard player was thrilled to be asked to work on this other project, so that was not a problem. He and I were just about finished the parts when the producer burst into the studio with his gun and threatened to shoot us both.

That took all the diplomatic and psychological skills I had learned from doing thousands of sessions to defuse the situation and calm everybody down. And the following days, I had to sit next to this producer for hours while working on his project. It permanently damaged the relationship, but we got along well enough through to the end of the project. I never saw him again after the album he was producing was finished.

We are fortunate in the U.S. that most of the time we can hop in our airplane and fly just about anywhere and there is no requirement to tell anyone or to talk to Air Traffic Control if you do not want to. It is an amazing freedom, and explains why the U.S. has always been the leader in aeronautics. Pilots come from all over the world to be trained in the U.S.

But there are times when you want to talk to a controller, or times when you are required to do so. Where I live in the Northeast, we have some of the busiest airspace in the world, and to keep all those aircraft flying safely and efficiently, the FAA restricts a lot of airspace from casual flying. Around every major airport in the U.S. there is a 50-mile ring of airspace that can only be flown in after you have received a clearance from the airport's controllers.

And any flight on an Instrument flight plan requires constant contact with the ATC system.

Our air traffic control system is based on human beings talking to each other using their voice. That may seem archaic in the 21st century, and there have been moves to automate some of this. But the human voice has proven to be the best way to do this, even after 80 years of using it.

This works because of several obvious reasons and a few that are not so obvious. First, the words and phrases used by controllers and pilots are standardized, and written into the regulations. Instructions will always be in a standardized language and in a specific order. The pilot's response is also standardized and required.

A controller's main commodity is time. That means every instruction has to be short, crystal clear, and precise. The pilot has the same obligation. In busy airspace, there is just not time for any variation. All parties must pay close attention, because any transmission by the controller could be for you. Missing an instruction could result in a dangerous situation, or, at minimum, a loss of efficiency.

Being precise in my writing and speaking has always been important to me, and my experience flying has sharpened that skill. So has communicating in Morse Code, which I talk about in another podcast episode.

By the way, all airplanes in our nation's airspace are treated equally, whether it is a Piper Cub traveling at 60 miles per hour, or a jumbo jet flying at ten times that speed. Controllers do an outstanding job of accommodating all the users of the system, and making vastly different aircraft transition their section of airspace with safety and efficiency. It is beautiful to listen and watch as controllers keep everyone moving toward their goal in nearly perfect coordination.

And it's all done with the human voice.

And listening to that voice not only tells you what you need to do, but it is one big party line where everyone under control of one controller will hear every instruction and response, for every airplane in the vicinity. That gives you a terrific overview of what is happening around you, and what you can expect your next instruction will be.

The controllers are talented men and women, but sometimes the airplanes pile up in the aerial equivalent of a traffic jam. It's the controller's job to keep everyone safe and to minimize delays.

The workload may become so great that the controller is stressed. You can hear it in their voice as they give one rapid-fire instruction after another to dozens of airplanes. Occasionally they lose their temper from the stress, but it is very rare in my experience. When that happens, chances are that is the last time you will hear that controller that day. He will be replaced by another, fresh controller who has been watching what is going on and can step in instantly and take over. It is a remarkable system and I am often in awe of how well these people do their jobs.

It's not unlike watching a really good producer, or talented musicians, especially studio musicians, do their job in the greater context of the session, and make it all into beautiful music. They do this even under stressful situations.

A trained ear can also be very useful while flying. In addition to keeping track of what ATC is doing and then complying professionally, there are other hearing skills that can come in handy. Here are some examples.

Although the radio communication is extremely orderly, there are times when two people start to talk at the same instant. Once you push the mic button (which is actually on the control yoke), you can no longer hear what is happening on the frequency. If another aircraft transmits over an ATC instruction, the controller may be unintelligible. But usually you will hear the two simultaneous voices, perhaps with a loud squeal. This squeal is superficially like feedback, but come from a different mechanism.

Most other pilots that occasionally fly with me find that noise incomprehensible. Often, I can hear the controller even under this adverse condition, due to years of separating out, say, the tenor voice in a harmony background vocal part. A non-audio world friend describes this as “hearing things underneath other things.” My co-pilots are always amazed that I am not only aware of the two voices, but I can focus on the one voice I may really need to hear, and understand what is said.

Small airplanes use engine-driven alternators to provide charging power for the aircraft battery, just like in a car. And except for somewhat more rugged construction, aircraft alternators are very similar to what’s in your car.

But what if something goes wrong with the alternator while you are flying? Newer technology has made alternators a lot more reliable, but not that long ago, alternators operating in the harsh environment of the air would frequently fail. Or fail partially.

The engine will keep running, but the electrically-powered equipment will stop as soon as the aircraft battery runs out of juice. That could be an emergency if you are in instrument conditions and suddenly your instruments stop working. On many airplanes, systems such as the wing flaps and landing gear extension also require electrical power. So, detecting the problem, and making a plan to get on the ground at the nearest suitable airport, may be critical.

One of the things that can go wrong with an alternator is the failure of a diode that converts the AC of the alternator into the DC that the battery and equipment needs. There are usually multiple diodes in the alternator, and it is rare that they all fail at once.

But what if one diode fails? How would you know? The alternator will keep putting out power, but at a reduced level, which you might not notice for some time.

This is where your trained ear comes in. Most electrical systems, in both airplanes and cars, contain not only the DC component of the alternator output, but a high-pitched impure tone that varies with engine speed. This is usually filtered out pretty well, but it still can be detected in your headphones at a low level. You may have noticed the 400Hz whine in your headphones on an airline flight. Similar phenomenon.

When a diode fails, the level of the tone will increase, and the character of the tone will change. It's subtle, but I always notice it.

Back at the maintenance shop, I'll tell the mechanic that I suspect a failed diode in the alternator. They used to think I was nuts, but since I was right every time, they took me seriously after a while. My hearing saved me from a possible dangerous situation.

Here's another example, which coincidentally involves the alternator in a peripheral role.

Most airplanes use belt-driven alternators, and when the belt breaks, or just needs replacement, the propeller has to be removed from the front of the engine. Stupid, yes, but it is impossible to stretch an alternator belt around a propeller that is 6 feet in diameter or more.

Propellers are attached with multiple bolts and removing it takes some time. And the propeller has to re-installed in a particular position in relation to the engine rotation. Otherwise there could be a dangerous vibration set up that could damage or destroy the engine.

Simple airplanes have simple propellers. More advanced airplanes have propellers where the pitch of the blades can be changed to optimize their performance during different segments of the flight. In this example, the propeller was on my first airplane, which had a simple, fixed-pitch propeller.

The propeller can be installed in multiple ways, most of them wrong, so the mechanic will mark the propeller to make sure it goes on the right way. But on a simple two-blade propeller, there are two acceptable ways, 180-degrees apart.

One day, the alternator belt was replaced and the propeller re-installed – but 180 degrees off from where it had been. Still perfectly acceptable.

But when I made a test flight after this maintenance, I immediately felt that something was not right. The airplane just didn't sound right. Every indication was that everything was functioning perfectly, but my hearing said something was wrong.

Back at the shop, I told them what I heard. It turns out that one mechanic had removed the prop and another had reinstalled it, but they had different conventions for marking the position. It was re-installed 180-degrees "out-of-phase" from what I was used to. No danger, just different.

They were skeptical but agreed to "reverse the phase" of the prop. Everything was then back to normal, as far as I was concerned.

Hearing can be a powerful tool for the pilot, especially in an airplane that they have flown many times. My recording background alerted me to this propeller problem.

Navigating an airplane from one point to another can be done several different ways. If the air is clear, and you can see the ground, you can navigate by landmarks on the ground. Rivers and lakes, towns and cities, mountains, the ocean, airports, and even highways and railroad tracks can help orient you. For this type of flying, special maps are produced which show airports as well as significant ground features, such as towns and cities. In the past, those were beautifully printed multi-color charts, each covering a particular area. It took dozens of these charts to cover the entire country. You had to buy the ones you needed for a particular flight, and the charts were updated several times a year. An out-of-date chart was not legal for flying.

Different charts are used for instrument flying. They lack all the ground detail, but do show ground-based radio navigation stations, and airways that connect them like highways.

Today, hardly anyone carries paper charts. It's all on a navigation display in front of the pilot and/or on a tablet computer.

Flying by chart and looking out the window is how student pilots are taught to navigate, and it remains a useful skill throughout a flying career.

Of course, that method does not work if you are in the clouds or if the ground is covered in fog. And its usefulness diminishes at night.

Under those circumstances, radio navigation aids are used, which historically consisted of ground stations that transmitted a continuous signal that told you the direction to the station, and what bearing from the station you were on. Many even told you the distance to the station.

But those ground-based navigation systems are being rapidly replaced with satellite-based navigation, using GPS and similar space signals. That works great, but of course it is also a single point of failure, so a skeleton network of ground stations remains, mostly as a backup.

These systems use a circular instrument, marked in degrees around the circumference and capable of being manually rotated to the direction you need to go. A vertical needle, like the pointer on an analog audio meter, moves from side to side to show if you are on course or drifting off one way or the other. It's a visual presentation, and it works well, and with practice it becomes a routine task to keep the needle centered.

For vertical guidance to the landing runway, a horizontal needle moves vertically to show whether you are above or below the glidepath. That combination navigation system, called an Instrument Landing System or ILS, will guide you right to the proper point on the runway for a safe landing, no matter how poor the visibility.

The ILS is still used most of the time by airliners arriving at the airport.

And by the way, as I mentioned in the podcast episode on Morse Code, all those ground-based navigation stations are identified by a Morse Code signal that the pilot is required to check. This ensures that he or she is lined up for the proper runway and the system is working properly.

But before these systems existed, there was another radio navigation system that relied on the pilot's hearing to keep them on course.

This system was essentially gone by the time I started flying. There may have been a few of these systems still in use in other parts of the world, but none of them were in my area. And my airplanes have never had the required equipment, which, by the way, were vacuum-tube based.

Here's how it worked:

The pilot tuned his special navigation radio to the proper frequency for the station he needed to use. The ground station transmitted two Morse Code signals, one of which was an A, which is a dot followed by a dash. (INSERT A Code). Simultaneously, a second code signal sent an N, which is a dash followed by a dot (INSERT N code). If the airplane was off course, either the A or the N would dominate. The dominant letter would tell the pilot which direction, left or right, he was off.

When precisely on course, the two characters would merge into a continuous tone. The A and the N were timed so that they filled each other in and could no longer be heard as two separate letters.

Wow! This was a navigation system for an audio guy! No needles, nothing but what you heard in your headphones indicated how you were doing.

As I said, I never got to experience this system, but I did run into some old airline and military pilots who had flown this way. They seemed to universally hate it.

Perhaps I would hate it too, after the novelty wore off, but I would have liked to try that system. I wonder if it would have been easier for me than watching a needle.

Flying with a needle-based navigation system works well, but I think of it as driving down a highway where you have a window on the floor of the car and all you can see is the white line. Your job is to keep that white line centered in the window at your feet. That does not sound like fun at all, and in reality, the required precision is not as tight as it would be to keep a car centered in a lane. But it still takes a bit of brain power to interpret the needle and make the continuous corrections to keep it centered.

In the real world, most airplanes equipped for serious travel have an autopilot that is coupled to the navigation equipment. This will track the navigation line with precision in most cases.

GPS navigation is very precise and usually accurate to less than one meter, even in the vertical direction on an approach to a runway.

One of the other things that is challenging but rewarding in both flying and recording, is following the flow of events and keeping everything not only on course, but also doing so elegantly and smoothly so that the mechanics of what you are doing disappear.

My instrument instructor many years ago told me to imagine that my grandmother was in the back seat. She was afraid of flying and prone to motion sickness. My job was to fly the airplane so smoothly that grandma could relax and take a nap.

Although we don't want to put our recording clients to sleep, it is still a worthy goal to make the recording process as smooth and relaxing as possible. For example, making the transition from one mode to another as smoothly as you can.

In flying, that means making a descent so smooth that nobody onboard realizes that it is happening. It means making a turn so smoothly that it is imperceptible to the passenger. Because of the way airplanes turn, this is entirely possible.

In the studio, it means going from tracking to overdubbing with so little fanfare that the musicians hardly notice. It means changing a mic for a better sound is done with so little distraction that the singer doesn't lose focus on the song. It means during a mix that level changes needed to accommodate the dynamics of the song are done so smoothly that no one ever notices.

I'm sure you can think of many other examples for making a session a pleasant experience for all involved.

I found that when I followed the guidance of my instrument instructor on how to handle the airplane with elegance, it became a way of life for me in general, whether I was flying, driving, doing a session, or just interacting with people. It is a valuable skill for me.

Flying requires you to move through our atmosphere, which is constantly changing and rarely predictable except in the broadest sense. For example, descending from cruising altitude to landing means going down through air that will have constantly changing characteristics. For one thing, the air will become denser, which requires adjustment of the fuel-air mixture to the engine. The wind speed and direction will change during the descent. As a general rule, the airspeed will increase because you are now going "downhill" and less power is required for a given airspeed. The temperature and pressure will increase, which affects the engine and the air that you breathe, not to mention your ears.

In the summer, the humidity will increase, which can cause ice to form in the carburetor of many engines. That can cause the engine to quit, if you don't properly manage the temperature of the air going into the engine.

Often the turbulence will increase as you go lower, because of the effect of terrain on the wind flow, or from heating of the ground causing hot air to rise. In that case, you might have to slow down for the comfort of your passengers. Turbulence can even affect your ability to adjust the avionics and engine controls, if the bumpiness is really bad.

Airplanes land into the wind, in an ideal situation. The pilot picks the best runway for a landing, unless the airport has a tower and a controller assign the runway. If there is a single runway at an uncontrolled airport, it could be used in either direction. It’s up to pilot to determine, while being aware of which way other airplanes are taking off or landing.

We land into the wind because that gives us the slowest speed in relation to the ground. The airspeed and the groundspeed are seldom the same, at any point in the flight, because the speed of an airplane across the ground depends on which way the wind is blowing, and how hard. The airplane only responds to the wind it is flying through. It has no idea of how you are traveling across the ground.

Landing into the wind means that the speed when the wheels touch down on the runway will be minimized, which shortens the distance to stop.

But the wind is seldom constant, in either direction or speed, which makes the landing process a challenge of constantly changing conditions.

Flying in general means continually re-evaluating conditions and optimizing your response for the greatest safety. comfort, and efficiency. It’s a challenge that never ends, and that means you have to always try to learn from your last flight, and evaluate how you could have done better. I feel the same way about recording. If I don’t learn something new from every session, I am not doing it right. After every flight, and after every recording session, I do an internal debrief to review what transpired, what I could have done better, and whether something new I tried made things work better or worse.

Back to our landing. More often than not, the wind is not precisely aligned with the runway. There is always some degree of a crosswind. That doesn’t make a lot of difference in cruising flight – you just have to aim the airplane slightly in the direction the wind is coming from, to compensate for it trying to blow you off course. It slows you down somewhat, but otherwise it is not a big factor.

But transitioning this machine-of-the-air into a machine-of-the-ground means that, without proper technique, your wheels will touch down in a different direction that you want the airplane to go on the runway. In an extreme, this can mean damage to the landing gear, or even a loss of control of the airplane. It might suddenly go off in a direction that leads to a collision with something off the runway.

Most of the time, it’s not that dramatic. But getting the airplane onto the ground smoothly will always be challenging. We fly in a three-dimensional environment, with two different frames of reference, and it’s a never-ending challenge to get that airplane on the ground so smoothly that the passengers don’t even feel it.

They may hear the chirp of the tires as they suddenly go from zero to 80 miles per hour or more, but if you do it right, everything is smooth.

Think about what it would feel like in your car if you suddenly were dropped just six inches while barreling along at 80 miles per hour. Imagine what that would do to your comfort. Now maybe you have a better appreciation of the challenges of landing an airplane so no one notices you’re on the ground. The airplane is descending at a rate of 8 feet per second or more before transitioning to near zero feet per second, all the while aiming for a specific point on the runway where the wheels will smoothly touch down. And that is all while maintaining the perfect airspeed for the weight of the airplane at landing.

And that about the weather? It is always a potential danger, for any airplane. The biggest threats are thunderstorms, ice accumulating on the wings, low visibility when landing, and winds on takeoff or landing that exceed the airplane or pilot’s capability.

But if we only flew when conditions were perfect, we would rarely get off the ground. There will always be some degree of a challenge with the weather, and a pilot’s job is to mitigate those dangers in order to make a safe flight. That means studying the weather constantly, starting days before the planned flight. Forecasts that far out are very general, but they are helpful in detecting any trends, either better or worse, which may give the pilot some insight into what to expect.

No airplane can fly through a major thunderstorm and not break into pieces. Even the rugged airplanes flown into hurricanes for weather forecasting have to be flown very carefully to avoid the practically unimaginable forces inside a storm. Today, almost all airplanes have some sort of onboard weather detection equipment that provides the pilot with timely radar images of precipitation. And many airplanes have avionics that detect lightning and display the distance and direction to a thunderstorm.

Those are just some examples of the challenges and dangers of weather. Forecasts are usually pretty good for the next six hours, the maximum duration that most flights will take. But they are not perfect, and you can almost count on encountering something not forecast on any flight of more than one hundred miles or so.

All these challenges would tend to make you think flying is too unreliable, too difficult to do well, and too dangerous. It is easy for a pilot to get into that mindset, and I have to say that over the years I have become more conservative about the weather I will fly in. I believe, too, that the weather has become more dangerous in the past 20 years or so.

But I have learned to live with the expectation that I won't always be able to safely fly to somewhere when I want to. Or maybe even just get there comfortably. A highly turbulent day may cause you to bang your head on the roof of the cockpit over and over, and that is not fun and not worth it in my opinion.

Instead of getting upset about it, I have learned that it isn't always going to be perfect, and you have to weigh the risks and benefits, and sometimes cancel or postpone the flight. Accepting that realization has made my life much more relaxing. There are some things out of your control and letting it make you mad is just wasted mental energy.

If a session is not going well – and let's admit it, not all sessions go as we had hoped – it is wasted energy to get upset about it. Re-schedule, if possible. Or try your best to salvage at least something useable from the day. Dealing with weather in the air taught me patience and acceptance of things that are out of my control.

On the other hand, there are a lot of things in flying and recording that are in your control. The secret is to never stop learning, never stop practicing, and never stop experimenting (if you can do so safely). After a while, you start to become one with the airplane and the air it is travelling through. You can do the same with your recording equipment and the flow of a session.

This is My Take On Music Recording. I'm Doug Fearn. See you next time.