

TINA So we're going to dive into human factors. There are kind of two halves to it. So about halfway
SRIVASTAVA: through we'll take a break. But let's just do the first half of it now, because I don't want to run over into Mark's upcoming talk at 4:00.

So human factors is something that's kind of near and dear to me. I actually really like this subject. When I was an undergrad, I took the course 16.400. I really strongly recommend it. We can only cover a very small amount today. You know, I have less than an hour to get through all of this for you. But I think it's really an interesting class, and it's very pertinent to everything related to aircraft and aerodynamics.

And this class 16.400 was one of my favorite classes. Still today, I refer back to it. And one of the things we did was also go through different NTSB reports. So I gave a link there as well. And you can read through accident investigations.

And not all of them are scary. You know, many of these reports, nobody actually got injured. But it's good to just read through what happened. What was the decision making? What led to the issue? It's a really interesting exercise.

And one thing in particular that we did in that course, 16.400, was really interesting is that they have you be on basically a flight simulator. So you're pretending to be a pilot. And then there's all kinds of inputs coming into you, which is really what you're going to experience in the cockpit when you're flying.

You know, you've got people talking to you on the radio. You have your passengers inside the plane. You have all kinds of inputs coming up on the screen. You're looking for other aircraft. You're trying to identify an airport that you're coming up on. There's a lot happening, a lot of information.

And then we had to basically talk about if a light went out, the absence of a light, trying to expect a pilot to identify that is totally unreasonable. So it was really interesting. And taking this course as an aerospace engineering student at MIT the lesson was you need to design these things to be better, because if you engineered this system such that somebody under that much stress and looking at those many inputs were supposed to notice a light going out, that's totally unreasonable.

Now, on the other hand, talking about a pilot, we will talk a little bit about how many inputs are on a person with a pilot, how a lot of things are attributed to pilot error. The whole purpose of this course and the whole purpose of learning to fly is how you can minimize the pilot error aspect, not the engineering design aspect. But certainly, it's good to experience both sides, designing the aircraft and the avionics, as well as flying the aircraft.

So one thing I really want to point out-- it's little bit morbid, but I just want to talk about accidents and what causes them. Well, a very large number of accidents are what's called controlled flight into terrain. Does anyone know what controlled flight into terrain means?

AUDIENCE: There's no instrument error or adverse weather, but mostly human error that would be playing into [INAUDIBLE] something.

TINA SRIVASTAVA: Yeah, so what he said was that there's no instrument error and it's pilot error. So it's not necessarily that it means that it's pilot error. But what it's saying is that there's nothing physically wrong with the aircraft. So it's not that the engine broke. It's not like the case with Captain Sully where birds were ingested into the engines and the engine stopped working. But it is the case that a fully functional aircraft was flown into terrain, into a mountain, or into the ground. So why does that happen?

So as we just heard, it's the pilot's fault is one of the most common answers. They attribute things to pilot error. And the NTSB does this a lot. If you watch the movie about Captain Sully, it made it seem like the NTSB was out to get him as well. I've heard the reality is that they were much more friendly towards him. But the situation is that that's kind of a natural thing that they have to explore. They ultimately found that he wasn't at fault, but that becomes a big issue.

So I don't think that it's always the case, again, that it's pilot error. Please take 16.400 and look into that. But for the purposes of this class, for being a pilot, you need to be aware of all the things that are under your control. How do you get a really good weather briefing? How do you make sure you're prepared, so that it is not your fault and you don't have any accidents?

So just to get you in the zone for the types of things we're going to discuss today, here's a practice question. I just want to see where people are on this. I know I haven't taught it yet, but I just want to know what you think the answer is so I know how much time to spend on these topics in the next couple slides. I'll give you a chance to read it.

OK, so how many people think it's A? All right, how many people think it's B? We had movement on B, but nobody fully raised the arm on B. All right, C? Lot of hands raised on C. All right, how about D? Now that everybody raise their hands on C, almost no one wants to admit D. All right, so it is, in fact, spatial disorientation.

So we're going to talk about the first half aeromedical factors. And then we'll take a break. And then we'll get into the aeronautical decision-making.

All right, so aeromedical factors, so Philip has already talked about some of the regulations associated with getting your medical certificate and having an EMT or an aviation medical examiner basically check you out. So there are a lot of physiological factors that can affect a pilot. And some of those you know are unrelated to that medical exam that can happen to any of us. So we're going to go through the ones that are listed here.

So hypoxia, it basically is related to not having enough oxygen, or having a reduced amount of oxygen. And there are a lot of different types of hypoxia. And it results in a lot of disorientation. A lot of things that you would be able to do normally, you won't be able to do in those types of conditions. So impaired judgment, visual impairment drowsiness, a lot of issues can happen if you're under that situation.

So let's see if we've got this video going.

[VIDEO PLAYBACK]

- And as you feel your symptoms, go ahead and list what they are.

- Six of spades. Six of spades. No symptoms yet.

TINA He's taking off his mask. So he doesn't have the oxygen.

SRIVASTAVA:

- Two of hearts.

- Do you have any of air [INAUDIBLE]

- I think I have tinkling in my toes, in my toes, in my...

- What was the last question?

- What was the last card?

- Four of spades. Tingling in the toes right now.

- [INAUDIBLE]

TINA

So if you heard what he just said, he's feeling tinkling in his toes, tingling in his toes.

SRIVASTAVA:

- Four of spades.

- What are you symptoms.

- Four-- Four of spades. Four of spades.

- What are your symptoms?

- What are you feeling right now, 14?

- Five of spades, five of spades.

- Good. [INAUDIBLE]

- What do you feel, Sir?

- Four of spades. Four of spades.

- What's your symptoms, sir?

- What are you feeling, 14?

- Four-- four of spades, four of spades.

- What's your symptoms, sir?

- Four of spades, four of spades right now.

- Where did you get the card that you're looking at. What card is that?

- This is four of spades.

- [INAUDIBLE]

- Four of spades, four of spades.

[END PLAYBACK]

TINA
SRIVASTAVA: I'll let you watch the whole thing. It basically just gets a lot worse. But you can see-- and one of the biggest problems is also maybe not being able to realize that there is a problem. So that's what makes it even more of an issue.

Another issue is carbon monoxide poisoning. So this can actually happen in the aircraft that you fly just based on where the heat comes in. And you get headache, drowsiness, a lot of issues there, blurred vision. The way to detect that is there's actually a CO detector, a carbon monoxide detector, inside the aircraft. And so when that middle part becomes very dark, then you'll know that there's an issue.

And so it's good to know what the symptoms are. So if you're starting to experience those symptoms, you know what the problem is. And you can, for example, open your window to get some fresh air into the aircraft. Some aircraft, even certain Cirruses have supplemental oxygen. So you can use that as an option as well.

There's another video. Just for time, I'm not going to go through it. But there's a lot of issues associated with high G-force. And you might have seen some things with the *Top Gun*, which we heard from Laz is a terrible representation. But even on that one, when they're pulling high-G maneuvers, we've seen loss of consciousness and other issues.

Another one that you might have actually heard of this before is hyperventilation. Some people here on the ground experience this. And so you might just be over anxious, breathing too quickly. It makes you not be able to breathe properly. You might need to just sort of take a break, breathe into a bag. Another good reason to have a co-pilot with you.

So a lot of the issues in terms of the disorientation that you face are somehow related to how your inner ear works. So the fluid in your inner ear is sort of related to how you feel motion. So I won't get into the details. You don't actually have to know a ton of detail about it.

But one thing to know in terms of how you feel motion is that you have fluid moving in your ear canal. You can't actually really detect the fluid. What happens is you have these little hairs that come up. And so when the fluid changes direction-- so let's say that the fluid starts moving in a particular direction. Then all these hair pieces start moving, and so you feel that motion.

Now, the fluid can continue to move in that direction. But over time, the hair follicles will

basically resume where they are. They won't feel motion occurring. Or they'll basically be stagnant. So it could be the case that the fluid is moving, and the hair is sitting like this.

Now, all of a sudden, when the fluid stops moving, the hair tries to just return to its previous state. And when that happens, you might actually think that you've started moving in the other direction. So this is an issue where, basically, if you are flying along and you start turning and you're in a constant rate turn, you might start feeling like you're not turning. And then, when you come out of that turn-- so you roll out and now you're straight and level again, you feel like you have just started turning to the right.

So even though now you're flying straight and level, your ear is telling you that you've turned to the right. And so you tried to correct that by turning back to the left. So it might be the case that your airplane's actual motion was constant rate turned to the left and then it flattened out, but you don't realize you're flat. So you start turning again.

So these are reasons why you don't want to rely on your inner ear. People refer to it as flying by the seat of your pants-- basically, what you feel as opposed to looking at the instruments. But actually, the seat of your pants is primarily your inner ear is what's giving you all these indications.

So there's a lot of things that can contribute to disorientation. So we already talked a little bit about spatial disorientation. Well, there are a lot of things that-- we talked about the vestibular system, which is that inner ear. But also even visual cues can cause you to have spatial disorientation, and then the feeling on your skin, so, you know, how much you're pressuring against the seat, for example.

So one thing about spatial disorientation is that when you're flying and you're looking out the window, your eyes are a big part of your orientation. So you're looking at the horizon, and if the horizon is tilted, you think you're turning. That's how you determine what's going on. But there are a lot of false cues you can get from looking outside.

So one thing is that-- and we spent a little bit of time talking about IFR flight earlier today, where you can't see outside the airplane and you're just relying on your instruments. Well, it's also good to do a reference check of your instruments because of some of the tricks your eyes can play on you. So, for example, if there is a low cloud layer that's kind of tilted, the horizon might look tilted and may not look flat. And you might think you're tilted when you're flat. Or you might think you're flat when you're tilted.

There is also other-- because of the motion in your inner ear when you actually have a motion in one direction, if you actually turn over, if you bend your head down, so let's say you're writing with a pencil while you're flying and you dropped your pencil, well, when you bend down, you actually feel emotions that don't actually exist. You might think you're sort of tumbling. And so that's really not good. Actually, if you fly out of Hanscom, you have to wear a badge anyway. And so you have a lanyard. Maybe you clip your pencil to that lanyard or do whatever you can such that you can reach everything you need to reach without physically bending over.

Or if you have a co-pilot that is also could be a pilot in command or safety pilot, you can ask them to take control. And we talked about positive exchange of controls. Ask them to take control of the aircraft before you reach down to pick up something, because it can have a more significant effect than you think it will.

And I will reserve some of the aerobatic talk for Mark to discuss some of these with you in more detail.

PHILIP

GREENSPUN:

Tina was talking trash about the autopilot. But that's also a good argument for if you have to bend down and get something, take your hands off the controls completely, that's better than leaving them on while you're fishing around for something. And if you have an autopilot, yet better.

TINA

SRIVASTAVA:

I think the autopilot is a very important tool to use when you're flying. I was just cautioning against it-- again, when I was flying on my check ride with Mark up there, mysteriously, the autopilot stopped working. And I had to perform everything without it. So you can't rely on that. When you're flying, it could stop working. But also your check ride pilot will not let you use one.

So this is something once you're flying, and you can even ask your instructor to help you with that, to actually get a sense of these disorientation, you can try you know climbing while accelerating, climbing while turning, these different types of motions, and also consider moving your head, making sure the other person has the flight controls to experience some of these motions. Or if you like, over near, I think, Building 33 or Building 35, they have a centrifuge, and you can experience a lot of these things as well.

So how do you deal with all these disorientation that are happening? One is just being aware of the causes of them help, making sure you know that they're there, getting briefings in

advance so you know what's happening. And, really, try to avoid sudden head movements when you're flying. So we've talked about scanning and looking for traffic, but avoid very sudden head movements while you're flying, because you are moving. And it can cause you to have a lot of effects. And then the other thing is just being well rested, eating properly. If you're hungry, if you're tired, your body is not at its best. It can also contribute.

So here are just some more examples of the visual illusions. And then there are also times when the visual illusions are worse. So nighttime, we're going to have a whole section of night flying tomorrow. But as it relates to human factors, I will say that you might think you're coming in towards the airport, but you're actually seeing a cluster of lights that's a city somewhere else. You might start going to the wrong place. If you don't keep referencing your instruments, you might not notice that you're kind of off track.

I'll give you one tip, though. I was flying to Hyannis. Hyannis is a city right at the base of the Cape before you go all the way down the arm of the Cape. And there's a great restaurant there right next to the Hyannis airport, a little French restaurant. During the day, they have kind of little sandwiches and pastries. And at night, it becomes kind of a nicer French restaurant.

So I was actually flying there at night. And coming into Hyannis, I was having a little bit of issue because my heading indicator kept processing and I wasn't sure exactly-- and things happened very quickly, because I'd been talking about the Bravo clearance, because going from Bedford over there, you're talking to all these controllers and worrying about your altitude. And so there's a lot happening.

And as I got close to the Hyannis airport, I wasn't exactly sure that I was going for the-- they have two different intersecting runways. I wasn't exactly sure I was lined up for the correct runway. So I just talked to the tower controller. And I told them that I was having this issue.

And so they lit up the runway that I was trying to land at very bright just for a moment so I could get oriented and get myself situated. That was very great. So good also to use other people, whether it's the flight service folks or the tower folks to give you help when you need it.

So this is also just another thing that happens at night. And we'll talk about this with the night flying that sometimes a stationary light can appear to move. And so you have to be careful. Don't trust everything you see.

A big one in terms of an optical illusion, whether it's day or night, is that if a runway is not flat, but it's actually inclined going up or inclined going down, not only as it relates to performance when we're talking about how long it takes you to land, but also as you're coming in, you might think that you're a different place than you are. This is also the case if the runway is wider or narrower than you're used to.

So at Hanscom, you might have very wide runways. If you fly out of Beverly, you have narrower runways. So just that difference can make you think you're at a different orientation or you're higher or lower than where you are.

PHILIP

Tina, can you go back to that one? So basically, they're saying if the runway is sloped and you rely on your ordinary sight picture, you might follow a higher or lower than standard guide path.

GREENSPUN:

TINA

SRIVASTAVA:

Yeah, absolutely. So what it's saying, the top one is showing that, you know, obviously, that's just when it's flat. And so when it's inclined up, you might you might try to be farther away, so that you get the same picture. So that the dotted aircraft is where you should be. But the solid aircraft is where you might actually be, where you're trying to compensate because of the illusion.

And then, if there's a featureless terrain, it can really affect you as well. So like right now, we have a snowy condition. So it's harder to see what's happening. It makes it difficult. And in general, it makes you fly a lower approach, which is not good.

OK, and then just a couple more-- I won't dive into each of them. But fog or haze, different types of things, can cause a mirage or can cause an illusion. And so you really want to keep referencing your instruments to make sure you are in fact holding the altitude, or use your autopilot to help you out. And, of course, any reference system, so if you have a VASI or a PAPI, those are great tools that even if it looks like the runways, one place or the other, if the lights are all red, you're too low.

OK, another one is motion sickness. So one thing I want to tell you about motion sickness is when you go up and you take your first discovery flight, you come out of this class, you're ready to go, you might feel a little bit motion sick. And that's OK. You're in a tiny airplane. It might be bouncing around a little bit.

What I'm here to say is that that goes away. You can actually train your body to get used to it

and kind of get over that motion sickness. But, unfortunately, you can lose that tolerance that you built up if you wait a really long time between flights.

I'm at MIT, so I don't know how much I need to tell you about stress. I think we all know about stress. We have different ways of dealing with it.

But just as much as it affects your ability to take an exam at MIT, that stress can also affect your ability to fly and think logically as you might need to do aeronautical decision making.

PHILIP And that's a good time to think about whether you should bring an instructor along on a trip.

GREENSPUN: You know, if you're tired or you're upset about something, then be part of a two-pilot crew.

TINA
SRIVASTAVA: Exactly. Fatigue is a big one. If you do take my advice and look at those NTSB reports, a large number of them are talking about airline pilots that have just been flying for 22 hours and something happens, whereas if you really think through it, you know, maybe that issue wouldn't have happened, but they're so tired that those things result in an issue. So really be mindful of how much fatigue can affect your ability to fly and what stresses it puts on the pilot.

Dehydration and heat stroke are big ones. Here, in this area, it gets very hot in the summers. Make sure to bring a bottle of water with you when you go flying. It can be a big issue. And, you know, if you're feeling kind of lightheaded, take a drink of water. It can make a big difference.

All right, so no alcohol or drugs while flying or before flying. There are some specific regulations. They're much more strict than driving, which I think is a good thing. So please take a look at that, 14 CFR Part 91, the blood alcohol level and the time since the last drink. It's really not worth it. You're flying as a hobby, for fun, don't do something that's unsafe.

Some of these are ways to remember, the bottle to throttle examples here. So I'll let you take a look at those.

Also, don't carry drugs. I don't know if I need to elaborate on that.

OK, so we talked about vision. Vision is one of the things that in your medical exam, you're AME is going to look at your vision and test your ability to see. One thing to keep in mind is that when you're looking out your windshield, you can basically kind of zone out. And so you think you're looking out your windshield and you're scanning for aircraft, but you've sort of stopped paying attention.

So one thing that they recommend you do is actually have a series of very specific eye movements. I just moved my head. But, again, don't move your head. But kind of look with your eyes to scan across, so that you're actually specifically deciding and you're specifically looking and scanning the air for other aircraft. And tell this to your passengers.

You don't have to be a trained pilot to look for aircraft. I always tell all of my passengers. Look out the window. Tell me if you see other aircraft.

OK, so we're going to dive into aeronautical decision-making. One quick thing I'll say is that I brought a couple of magazines here. Although some of them are older, they have some good content. So this one is about aviation safety. For folks today that we're interested in the talk about instrument flight, there's actually a magazine called *IFR Refresher* and specifically focuses on topics related to instrument flight. And then a number of these *Aviation Safety* that talk about topics that I felt were relevant, such as flying with icing is one of the ones here and flying at night. And then there's a general IFR magazine that just talks about some good articles about how you handle your skills in flying instrument approaches, such as ILS. So these are kind of first come, first serve over here.

So aeronautical decision-making-- so how you make decisions when you're in the cockpit can really affect how you successfully exit a very negative situations. So whether it's what we were just talking about with regard to having spatial disorientation or having carbon monoxide poisoning versus an engine failure or specific issue or a weather issue, the way that you go about making a decision can significantly impact the outcome. So we're going to talk about decision-making, hazards, how we go about evaluating risks, and having personal checklists.

So in aeronautical decision-making, one thing to think about is just that there is a way that you can teach someone how to make good decisions. So in addition to learning about your airplane and learning how to fly, one thing that throughout your pilot training is that you'll learn how to make decisions.

So crew resource management is one specific aspect. And we've been alluding to that all day, talking about how to use either your co-pilot or whoever it is that's sitting next to you in the plane or your other passengers as well. There are a number of aircraft that we talk about, and we discuss the FAA regulations earlier about mandated requirements to have a co-pilot or sometimes other folks. But there even people outside your cockpit that you could rely on-- air traffic controllers, we talked about, flight service stations, for example. So again really think

about when you're flying, although the FAA might require just a crew of one, whether you really are all alone or there are other people you can rely on.

So there are a lot of aspects to making good decisions. And this is part of why pilots love talking to other pilots. They also just like discussing if they encountered an issue, how they went about dealing with that issue. And talking to other people about their experiences is actually a good way to learn.

One thing you should also know is about your personal attitudes. I think that might have been another reason Laz, our F-22 pilot yesterday was so against *Top Gun*, the concept of being a very arrogant person that violates the rules is really not a good stereotype for a pilot because people that fly like that are more likely to have accidents. How you can modify your behavior, how to recognize and cope with stress, we could certainly use that here at MIT.

And then how to really assess risks properly, we talked about weather as an example. How do you know if you have the right weather information? Have you evaluated a risk appropriately? And we've really tried to give you pointers and cues for that. Especially if they tell you VFR flight not advisable, it's not advisable. That means it's probably a bad idea.

So hazards and risks-- so a hazard is basically a condition or an event, something that you might encounter, whereas risk is basically your assessment of how likely is that risk? How likely is that hazard going to come to be? What impact could that hazard have on your outcome?

So one thing, again, is about your attitude. So don't be like those *Top Gun* pilots. If you're very anti-authority and you say, you know, I don't care even if the weather folks said VFR flight not advisable, I'm a great pilot. I can do it any way. That type of attitude is probably going to lead you in unsafe condition. It's really not a good idea.

We also discussed the concept of personal minimums and setting personal minimums for yourself. The reason is that today, for example, or after you've done a little bit of flying, you might have a good sense of what you're comfortable with. You might have gone up with a lot of gusting winds. And so you might decide that, hey, I was a little bit uncomfortable with winds gusting to 20 knots. Even if my aircraft is capable of it, I think that's something that until I get a little bit more experience, I'm going to set as a personal minimum I don't want winds gusting over 15 knots before I decide to take a flight by myself. So you can set your personal minimums.

Why are we talking about that? Well, the reason is on the actual day that you're flying, you may re-evaluate the situation. You might really want to go flying that day. Maybe you've already arranged with a friend to come with you. Maybe you have a destination you're really trying to reach.

Philip described a number of situations where he's flying cross-country. He has a plan. He has to follow it. And he can't really be away missing several days where he was trying to go.

And so sometimes in the moment you might have an impulsive nature. You might decide that I think I can do it. I'm sure it's fine. So having personal minimums and actually writing those down are a really good way to hold yourself accountable to what you had decided in a calm state of mind was a good restriction.

So one thing to keep in mind is the assessment of risk. You also shouldn't be overly risk averse. The FAA has guidance on what type of equipment is required in your aircraft. So certain things are that's required. If it's not there, you can't fly.

But there are other things that are optional. And so if there's a piece of equipment that's optional, that's not functional. There's a lot of importance around understanding what is the risk of that not being operational as an example. And we'll go through a checklist in a little bit to assess both your personal state of being, your aircraft state of being, the environment, and assessing all those risks together.

But for a given risk, you want to know, one, how likely is it? So maybe if you're talking about weather, there is a chance that a storm will come in. There's a chance that it won't.

Then also the severity, are we talking about some light rain showers? Or are we talking about a very, very dangerous front with icing or thunderstorms? So that's the difference between the likelihood and the severity. Both of those have to be assessed for a given hazard that you encounter when you assess its risk.

So there's this way of checking yourself. It's called IMSAFE. So this is just determining just you-- not the airplane, not the environment-- as a pilot if you're safe to fly. So do you have an illness? Or are you taking medications that might affect your ability to fly? Are you very stressed out? Do you have your thermodynamics final coming up and you're really nervous about it?

Again, we talked about there are also legal regulations. You can't have alcohol or drugs that could affect your ability to fly. Are you just very tired? Or really, just are you very distracted by something that's happening?

The PAVE checklist is the one I was referring to that actually considers all of these different things. So the IMSAFE is just the pilot. A is referring to the aircraft. So this is when we're talking about are certain things different about the aircraft?

Maybe it's a new aircraft that you're not really comfortable with. Maybe you're checked out, but you don't have that many hours in that particular aircraft. Or maybe you know we've talked about the difference between steam gauge and G1000. Maybe you're really used to flying steam gauge and this is a G1000. So there's nothing actually wrong with the airplane, but you may be less comfortable.

Environmental, so that could be weather. That could be flying to a new airport. That could be flying to an airport that has some special conditions. Maybe it's a grass strip. You're flying to Katama, which is a grass runway out at Martha's Vineyard right next to the beach. It's really beautiful. I recommend it. But maybe if it's your first time, flying to a soft field, that could be a concern.

External pressures, that's what we were just talking about. You're already committed to being somewhere later in the day. You've met up with somebody. You're with a friend. You had decided to take them flying. They really wanted to go. But the weather is looking a little bit iffy.

So one thing that's good about this PAVE checklist is to kind of put things in perspective. That maybe you're feeling a little bit stressed out or distracted about an MIT exam, but the aircraft is the one that you've been flying a lot. You're very familiar with it. You have a lot of time on the aircraft. Everything is working well. You have a good amount of fuel. The weather's great. It's a beautiful day. You're flying to familiar airports. And you don't have any external pressures that day. There's no one you're trying to meet. There's nothing you're trying to get done.

So that might be a good day that, OK, one of these things is a little bit iffy, nothing crossed your minimums, but it's just something that maybe you could still go ahead and fly. However, if it's multiple things, if it's a different aircraft. It's a different location. You're having stresses. These start becoming times that you want to take these risks even more seriously, because as they come together, it could affect your ability to have a safe flight.

So just these types of personal checklists are a great way to assess risk and make decisions as you're trying to decide whether or not to go on a flight. And these are just a breakdown of some of the things I just said on the environmental condition. So nighttime is also on there. Tomorrow, we'll talk about night flying in particular and the fact that basically in the US with just your private pilot's license, you can fly at night.

A lot of other countries consider night flying just as advanced as instrument flying. And you need your instrument rating to fly at night because of all the concerns about not being able to see much outside your airplane. So be mindful that, you know, it's a slightly more challenging condition to fly in. And how does that affect your ability to assess the other risks that might be taking place?

I really would recommend, especially when you're first getting certified, you don't really make plans anywhere near the time that you're supposed to be done flying. Most flight schools will give you a flight block of 2 and 1/2 hours. Make sure that you don't have to be anywhere even for a few hours after that. In case the weather got bad, you had to land somewhere else, you don't want those external pressures affecting your decision-making when you're in the cockpit.

This is another way to think about it in terms of this 5 "P" checklist. So there are certain kind of different parts through the flight. We discussed the pre-flight, take-off, while you're kind of cruising along, you're descending and you're flying, and it might be good to kind of look through all of these different aspects about when you're flying and kind of checklist for yourself to understand what's happening.

There are a lot of different resources that talk about aeronautical decision-making. I think one of the best resources is really talking to other pilots about experiences that they've gone through and learning after you go through an experience reflecting afterwards whether it's through your instructor, with your friends. You know, what happened? What could I have done differently? Was that the right decision to make?

So even these little things, like Phillip was talking about flying with Oxana, trying to avoid some weather. There was rain. Thinking about how he evaluated that risk of that thunderstorm. What could he have done differently? Was that the right decision? And in general, making a conservative decision is good, because it's your life at stake that we're talking about.

All right, so I think we've talked a lot about this. Are there any specific questions on aeronautical decision-making or human factors in general? Yes.

AUDIENCE: You mentioned currency. Is there like a recommended frequency, or like rule of thumb, like how often you should be flying to be maintaining your skills?

PHILIP We're going to cover that at the very end. There's a Cirrus that we put together this big matrix.

GREENSPUN: They don't tell you how often to fly to practice. But they tell you given how recently you've been flying and practicing, here's the kind of weather that should be challenging.

TINA So the question for those who couldn't hear was just about the currency. So are there rules
SRIVASTAVA: about how often you need to fly? And there are rules, especially related to carrying passengers at night, for example. There are certain legal currency requirements.

But just as Philip said, there's also just personal minimums that you might want to set for yourself. If you haven't gone flying for a month, you may be legally current, but may not be a good time to take a bunch of passengers to a new destination that you haven't flown to before.

PHILIP Yeah, so you remember from yesterday, there's that 90 day, three takeoffs and landings within
GREENSPUN: the preceding 90 days before you can carry passengers. That's a good minimum. A lot depends on the type of aircraft and how familiar you are with it.

So if you have 500 hours in a very logically designed airplane like the Cirrus, you know, then you're going to be safe probably without flying too often. In a more complicated aircraft, you know, that has buttons and levers just randomly strewn across the panel, which seems to be the industry standard, you know, if you haven't flown it for a month, you may actually be a little bit at sea as to where are the flaps? Where is the gear? So a lot depends on how many hours of experience you have in the type of aircraft you're going to fly and just how inherently challenging it is to fly. The practical currency requirements for a multi-engine piston airplane are going to be very different from those that you might use in the Piper cub.

TINA Yeah, when we polled the class earlier, I think there were 70 of you have really only flown
SRIVASTAVA: once or not at all. And so that's a lot of people that don't have flying experience. So I would say, you know, back before I had 200 hours, or even before I had 100 hours of flying experience, I actually set very strict currency requirements. I had to fly, you know, two times a week before I really felt comfortable taking up a passenger, when I wanted to fly relatively frequently with an instructor and practice stall recovery, these types of things. And I think that's good. Make it as much as you need to in order to be safe.

PHILIP

GREENSPUN:

Yeah. You could also decide again, if you haven't flown for a while, are you going to fly an IFR approach down to minimums, down at 200 feet above the runway in the clouds by yourself in an airplane with no autopilot, would be legal? Or you're going to say, look, I'm a little bit rusty, so I'm going to only fly on a fairly calm VFR day and get back into it? So a lot depends on the challenge of the flight that you're considering.

Who else has a question?

I'll tell you one more little story. A friend of mine had a twin engine airplane, a Cessna 340, which is a very complicated airplane with-- I think it has six fuel tanks and all kinds of levers. It's pressurized off the turbo chargers. Anyway, one engine caught on fire. So an engine caught on fire. He's got four or five people from his family in the back. And he manages to get the fire out by cutting off the fuel, I guess, to the burning engine.

He's right above Bradley Field in Connecticut. So that's one of the largest airports actually in the world. It's probably among the top few percent of big airports in the world in terms of physical size. They have regular airline service. They have a full-time fire department. They have a control tower. They have a runway that's about as long as Logan's, you know, like close to 1 miles long runway.

So he decides, well, I've got one engine. It's nighttime. It was night. The controllers are right here. Should I just, you know, spiral down and land on one of these huge runways at Bradley and the fire department come up and meet the airplane?

Or-- that's option 1. Let's see what you guys think. Option 2, let me continue to my home airport at Fitchburg, which is unattended. I don't think there's a fire department that's there. There's no control tower. The runway is pretty short, 4,500 feet. But on the other hand, it is the home airport. So it's very familiar. And he's got one engine left. You only need one engine to descend.

So what do you guys think, A or B? Land it at Bradley or go to Pittsburgh? OK, what do you think this guy did?

AUDIENCE:

He went to Fitchburg.

PHILIP

GREENSPUN:

He went to Fitchburg. And he wrecked the airplane. You know, he landed. But I don't know-- it's twins with one engine. They always say the second engine carries you to the scene of the accident. We'll talk about that tomorrow.

So they just are hard-- it's hard to maintain-- it's hard to keep them going perfectly straight. So, of course, he didn't go perfectly straight down the runway, went off the side of the runway, did some damage to the airplane. Nobody was hurt, fortunately. The punchline of the story is he doesn't tell this as an example of bad aeronautical decision-making he tells this as a story of good decisions and making good decisions as a pilot. And I'm not really sure why.

But anyway, I just wanted to tell you, like despite all those checklists, people can have very different perspectives on what constitutes a wise decision. But personally, I try to do-- you know, I have an ATP. But I try to do flights whenever possible that require only a student pilot level of skill. And that gives me a nice margin.