

**TINA** So now we're going to dive into the flight environment. All right. So the first part is flying.

**SRIVASTRAVA:** Actually, let me just pause there. Were there any other questions about the charts and the airspace? OK, good. They're kind of related to the flight environment, so feel free to jump in here. All right.

So flying. So there's a fair amount of work that a pilot is supposed to do-- is actually required to do before they fly. So you're supposed to become familiar with information that pertains to your flight. In fact, it's a very good idea to do so, that's exactly how you become a safe pilot. So it's important to understand information related to your flight. So there's not only the airport that you're taking off from-- and when Phillip talks about performance, he'll talk about the length of runway that's required, but you also want to know about alternate airports along your route. So if I'm flying from here to Maine, for example, there's a lot of airports along the route, I'd want to identify a couple along the way, understand what the weather forecast is for those airports, whether or not they have fuel, those types of things are very relevant to know.

You're also supposed to understand how much-- so we talked about-- so when you talk about aircraft performance, you'll understand what length of runway you require in order to land, and then you want to make sure that the airports that you've identified as alternate airports along the way have long enough runways for you to land. So let's talk about some of the paperwork.

So there's this acronym, ARROW, that's supposed to help you remember the types of things that you're required to have inside the airplane. So there's an Airworthiness Certificate, Registration. If you're going on an international flight, you need a radio license. It's actually pretty easy to get. So if you wanted to fly from here to Canada, you only have to pay \$60 to get your radio license and you can go fly to Canada, so it's great. And also the international language of aviation is English. So even if you go to Montreal, you don't have to learn French, you can speak in English and land there, so it's great.

So O is the Operating Limitations, those are displayed in various ways, such as your flight manual and placards, and we'll give you some pictures of placards so you see what those are. And then Weight and Balance information, and we have a whole talk just about calculating weight and balance I think tomorrow.

So operating limitations. So these are real restrictions on the aircraft in terms of what is the

maximum speed you can fly with and without your flaps extended, and which kind of procedures can you do. And we talked about certain aircraft that you're allowed to do these fancy aerobatic procedures in and other aircraft where that's not a good idea, because if you really push your aircraft to enter a spin, it may be very difficult to recover from it.

And so there are different things-- so one is called the POH or the Pilot's Operating Handbook, and I have a POH over here, and it has a lot of great information in it. So pretty much everything Philip taught you about aircraft systems as is in this book as well. It tells you about-- everything about your airplane's systems, its requirements, its restrictions, and how you calculate that runway length that you need to land and your weight and balance, all that information is inside these books. So this is an example of some of those limitations for an SR20 as an example-- we were talking about Cirrus aircraft. And so you can see, the same types of numbers that Philip was pointing out before, the different V speeds. And he had also talked about these maneuverability limits as well.

Minimum flight crew for a lot of these small airplanes is usually one, but some of the very big, complex airplanes and jet aircraft require the co-pilot as well, and some airplanes even require another crew member as well. So there are certain aircraft instruments that you require when you fly. So they're called equipment requirements. So a VFR day, which is Visual Flight Rules-- so a nice sunny day, no clouds, so you'll be doing VFR your entire time getting your private pilot's license except if you do a couple days of instrument training, but the vast majority of time, you're talking about a VFR flight.

So what do you need, you need some of those key instruments we were just talking about-- your airspeed indicator, your altimeter, a compass, and then a couple of things related to the engine. So you understand about the engine, its oil pressure, temperature, and you need to know things about your fuel. And a lot of them have alternates, you could measure your fuel from different ways, but somehow you must have a fuel gauge to know how much fuel you have.

You also need to have anti-collision strobe lights that kind go off, and seat belts. Who knows what an ELT is? Yes?

**AUDIENCE:** Emergency locator transmitter?

**TINA** That's right. And so that-- it's an emergency device that basically activates when your aircraft--  
**SRIVASTRAVA:** if your aircraft is under duress and is descending very rapidly, it goes off and emits your

location out so that people can come and find your aircraft very quickly. There are also some-- and these numbers, by the way at the top, in case it wasn't clear, are regulations. So they're FAA regulations. So 91.105 is a regulation about pilots sitting in their seat when you're flying the airplane. So for all practical purposes, when you guys were flying, you have to sit down and be the pilot and fly the airplane. This isn't like a big commercial jet we're going to get up and start walking around, so you need you need to basically sit down.

Seat belts. As a pilot in command, you also get to make the rules for your flight. So if you think you have some kind of rowdy passengers, you just tell them the rule is you must wear your seat belt at all times. The actuality is that there are certain times and restrictions where it's required. So taxi, takeoff, landing is required to wear your seat belt, but you can extend that rule and say, at all times you must always wear your seat belt. There's also an interesting regulation that says that passengers can't interfere with the crew members, but I will point out that depending on who your passengers are, they may or may not comply with that regulation.

We already talked about the different altimeter settings. So kind of-- it can be the case that you-- instead of being the perfect condition of 29.92, it might be the case that you need to adjust your altimeter to that local setting. So we talked about ADS where you can dial in the frequency of the ADS and it announces the weather information for a particular area. They will provide the setting that you need to set in that window. So they'll say 29.98 or whatever is the altimeter setting. Also, if you're flying over a bunch of places and you're talking to air traffic control, they will update you-- if they hand you from one air traffic controller to another air traffic controller, one of the first things they'll tell you is what is the altimeter setting for that area so that everybody is adjusted and everybody knows what altitude they're at. So there's a little knob on your dial, and you turn it until that window on the right says the right number.

Now if that's not available, you already have some information, which is the airport elevation. So also on those things being passed around, for a given airport, it tells you what the elevation is. So for example, if you know that the airport is at 100 feet elevation, you can just-- and you're sitting on the ground in your aircraft getting your airplane set up before you take off, then you know that you're at that 100 feet. So you can just keep turning the dial until it says 100 feet, and then that'll actually give you the setting in the window. There's some restriction-- yes, go ahead.

**AUDIENCE:**

What if you're flying into an uncontrolled airport or you don't have altimeter setting? How do you [INAUDIBLE]?

**TINA** So that happens a lot. So you can basically look at the nearest airport is probably the best way. And those are the times that you really want to keep in mind what Philip was talking about, that if you are going from a hot place to a cold place, you want to keep in mind that hey, I might actually be descending even though my altimeter says I'm not. But in general, if you have a local setting that's nearby, you're pretty much good. They don't vary dramatically unless the weather's changing a lot, in which case you really shouldn't be flying because it means there's a huge front coming in.

So here's an airport diagram. A lot of information here, but one thing-- so this is actually Bedford. And so you can see a couple of things you wouldn't see at other places, such as the US Air Force ramp. That's not going to be at other places. But you basically see these two intersecting black lines. So those are the main runways. And each runway is bi-directional. So on one side-- so it says-- the number's very small right here next to the mouse. So 11. So that's runway 11. And then on the other side it says 29. So basically you land in one direction, it's one number; if you land in the other direction, it's another number, and that number is corresponding to the heading of that runway.

And then you see a bunch of lighter gray lines. So those are the different taxiways. And there's all kinds of stuff here. I won't go through everything, but one thing that's really relevant is this acronym here. And it kind of looks like a lasso. What it's saying is, the land and hold short. So if you're given an instruction-- so when you have two intersecting runways, they might want to keep up the efficiency. They might want to have you land while they have another airplane taking off on the other runway. And so there is a line that says that if you given a land and hold short instruction, that you're supposed to land-- that you're supposed to hold short, you're not supposed to cross the intersecting runway because there's traffic on that runway. Thanks. Did everyone get the iPad had to look at the sectional? OK, great. Yes?

**AUDIENCE:** On the sectionals, I was looking at the Hanscom area, and I could not see anything indicating the Air Force Base and getting special symbol. Are there special symbols for military sites that do have aircraft taking off and landing? And can you explain what they are?

**TINA** Yeah. So that's restricted airports, for example. So they have a different color and different symbol around them that would indicate that they're a restricted airport. One thing that's kind of interesting is that even though Hanscom's at an Air Force Base, it doesn't have any particular restrictions. So you just get a nice private airport that you can land at that has

ginormously long runways, so it's just a great training airport.

So Philip, I just went ahead into the flight environment.

**PHILIP** Oh, OK.

**GREENSPUN:**

**TINA** So taxiing in the wind. So this is-- what do I mean by taxiing? So you must have heard of this  
**SRIVASTRAVA:** on commercial aircraft. So this is when you get from-- in that case, the jet bridge out to the runway. But basically as you're driving along the different roads at the airport that are not the runway-- the taxiways, as you're doing that, there could be wind. In general, as we talked about with regard to lift earlier in the day, you know you like having the wind coming at you-- and we'll get into performance and why it's really bad if the wind's coming from behind you. But usually the wind will be coming down the active runway. They decide which runway is active usually by the wind direction.

So there's a lot of wind going on, and when you're taxiing to the runway, you're probably going in different directions with respect to the wind. So one thing that's important is to think about while you're taxiing, you have to make certain corrections to your aircraft's controls-- so to the rudder and to the ailerons and the elevator at the back. And so when you're taxiing on the ground, your rudder is used to actually make turns on the ground. The ailerons and the elevator need to be turned in such a direction that basically results in your airplane staying on the ground and not inadvertently being lifted up by a gust of air.

So this airplane is what we would call a tailwheel, because there's a wheel back here at the tail. So it has two wheels up front and a tailwheel in the back. A tricycle gear airplane would have one big wheel up at the front and then two wheels-- so three wheels total, but instead of a tailwheel, it has one wheel up front. So in this case, a tricycle wheel-- so not like this, but with a wheel up front, what you want to do is if there's a quartering tailwind-- so a wind coming from behind you from the back, you want to dive away. So you want to turn your ailerons away and you want to push forward to dive away from the wind.

And if the wind is coming from the front, a headwind, you want to actually go into the wind with your aileron, and you want your elevator to be neutral. So instead of pushing in or pulling back, you just want it to be neutral. It doesn't matter as much for heavy airplanes, but for literal airplanes, you can get bounced around. And so it's slightly different for a tailwheel, so it's good to figure out which type of airplane you're training on and get used to how you would make

those corrections as you're taxiing.

There are a lot of runway markings and taxiway markings. One thing I would really encourage you to do is that the next time you're on a commercial flight, get a window seat and look out the window, and you can see all these markings as you go along. You might be able to identify which runway you're taking off on. And so I won't go through each of these, the actual runway is this red number.

So why are there two numbers? Why do they have 15 and 33? That's right, because runways are bi-directional. So depending on which way you're taking off on it or which way you're landing on it, it could be runway 1-5 or runway 1-3. The yellow ones are talking about-- there's a difference between when you're on the runway or on the taxiway versus it's an arrow pointing to it somewhere else. So this sign is on the one that you're on, and this one is saying-- so if you see this A like this, it means you're on taxiway alpha. If you see it like this with an arrow, it's says that way to taxiway bravo.

It's very important that you do visual scanning-- so you really look around for other airplanes. So when we talk about Visual Flight Rules, VFR, which is the vast majority of your time on your private pilot, you need to be looking outside the airplane to look for other airplanes to avoid. And it's unfortunate, but actually, most mid-air collisions occur near airports in good weather. So if they had been looking out, they could have seen the other airplanes. So when we're talking about the pros and cons of low wing and high wing, I was very focused on your visibility. So where you're looking in terms of you want to clear before you make any turn, you want to look before you go.

In fact, Mark Nathanson, the FAA examiner who's coming tomorrow, that's probably the easiest way to fail your FAA exam. He'll tell you to do a maneuver and you just start doing it. Fail. You have to first clear the area, you might even do a clearing turn. So turn in one direction and turn the other way, because you know your wings are kind of obscuring you, so that you can look all the way around, make sure there are no aircraft in the vicinity, and then perform your maneuvers. But of course, you can also talk to air traffic control and other folks to get traffic advisories. They will tell you, hey, there's an aircraft at your 3 o'clock 5 miles ahead of you. Those types of things are very helpful. They're not always required, but they're recommended.

So before we talk about right of way, I thought I would just challenge you with a question. Who

do you think has the right of way, a blimp, an aircraft refueling another aircraft, or a glider? So we're just going to do a poll. So how many people for blimp? We've got about 20 people for blimp. OK. How many people for aircraft refueling another aircraft? That was almost the same number, 20 people on aircraft refueling another aircraft. How many people for glider? OK, glider has the majority of the classroom here.

So the majority of the classroom wins, it's the glider. And this is a very complicated question. Obviously you would never be in a situation where a blimp, an aircraft refueling another aircraft, and a glider all coming together head-on, but the--

**PHILIP** Burning Man.

**GREENSPUN:**

**TINA** Yeah. So the glider wins because it is unpowered. And so unpowered aircraft have a priority  
**SRIVASTRAVA:** over all powered aircraft. However, if you're in a glider and you see a blimp, you know those things are slow, I really suggest avoiding it anyway. So there are a bunch of right of way rules that are all described in FAR 91.113. And so it basically talks about the order of operations. And kind of the big things to know is that if anybody is in distress or has an emergency, they usually just get priority over everybody else. Balloons can't really move that much and they can't decide where they're going, so even if you wanted to assert right of way, they're not going to be able to move. But then it really is aircraft that are unpowered get the priority.

There's also-- if you have multiple aircraft that are of the same class-- so two airplanes, two powered airplanes coming at each other, how do you decide who has the right of way? So there are some situations which is basically that two aircraft that are converging that are of the same category, the aircraft on the right has the right of way. So there are a couple of figures that describe that. So basically if two aircraft craft are looking head-on, then you both you both move to the right. It's good to have that rule of thumb. Yes?

**AUDIENCE:** Going back to the priority list, what category would blimp fall on?

**TINA** The blimp is a powered aircraft. Yeah, it's very slowly powered, but it is powered, and so it is it  
**SRIVASTRAVA:** powered aircraft. If I said balloon instead of blimp, then the balloon would have won. Yeah. The balloon-- sorry, the blimp is also frequently called an airship. So the FAA question might refer to the blimp as an airship. OK. So this was the right of way.

And then-- yes. So one thing that alters it is if you have an aircraft that's landing and it's on

final approach to landing, then it has the right of way, really, to land. So this is where we talked about the balloon has priority over all the others, the glider has priority over all-- over powered aircraft. The airship or the blimp has the priority over all other powered aircraft. And then if you're towing or refueling, then you have that priority as well. So this is a little diagram that shows you that-- it's very unlikely that you will encounter an aircraft refueling another aircraft.

So one thing to know is also just minimum safe altitudes. So in general, you're the pilot in command. You need to ensure the safety of yourself and your plane and your passengers. So in order to do that, the biggest consideration is that you're flying at an altitude that's safe enough that if something went wrong in your airplane, you would be able to land safely. So it's always good, regardless of where you're flying, to keep an eye out on where's the closest airport or where's the closest flat, clear field that you could land in, and you want to be at an altitude such that if you had an engine failure, you could make it safely to that place and land safely.

So that's why even though technically in some of this Class Golf airspace, you could be flying at 100 feet above the ground, unless it's a very, very flat desert where you could land anywhere, it's not a good idea if you can't safely land. Over a congested area, which we talked about is that yellow area on the sectional, you have to be higher. So the idea is just not to be a nuisance when one's very congested. And then do you want to talk to helicopters at all? Helicopters can do whatever they want is the ultimate rule of thumb.

**PHILIP** Yeah. So basically--

**GREENSPUN:**

**TINA** Actually, your-- sorry, your mic is over here.

**SRIVASTRAVA:**

**PHILIP** I don't need the mic, because I'll get up here, this is louder than the mic. So basically with a  
**GREENSPUN:** helicopter, just listen to the airplane. It's OK to lose the machine and yourself. So you can fly over downtown Boston quite low as long as you can always end up in the Charles River, for example. But you can't go below the-- there are no arbitrary numbers. You would just say, well look, I could auto-rotated to the street, or I could have auto-rotated into the river, and I wouldn't have destroyed somebody else's building or car. So that's the only rule for helicopters. Don't fly super low when there's an FAA safety inspector actually in your helicopter with you. That's a good rule of thumb

**TINA**  
**SRIVASTRAVA:**

Another thing that's very important that you just-- you don't be careless or reckless. So you're not supposed to endanger people's lives or property. We talked a little bit about placards and how they can have restrictions on them. So this is what we mean by a placard. So they're just things that are fixed to your airplane, and it has some instructions, whatever it's talking about. These in particular, for example, some of the never exceed speeds are listed, when you need to turn on a strobe light is restrict-- is indicated, for example.

So I think is really interesting about dropping objects. There isn't a rule that says you can't throw stuff out of your airplane, it just as that you have to know what-- where what you're throwing will land such that it doesn't damage any property. So there's some interesting pumpkin festivals around here that in the October time frame, they'll give you pumpkins and you can throw pumpkins outside your airplane and try to hit a giant X in the middle of a field, and there's no rule against it as long as you don't damage any property, so it's kind of interesting.

Formation flight is kind of cool, too. Obviously you can't do anything that would be hazardous, but if you are in communication with another pilot, you decided in advance that you wanted to do it, you can do this. So I actually had one MIT flying club flight, three airplanes that were part of the fly-out decided they wanted to do this, including myself. And so we had three airplanes, and we were nowhere near as close as these planes are to each other, but we were in constant communication with each other and we were watching each other and it was really cool to kind of fly together, and we actually landed as a flight-- so instead of each having our own tail number identified to an airport when we were landing, we picked an airport with an extremely long runway and tower controller, and we said, we want to land as a flight of three.

And so they give us clearance and basically-- a Cessna doesn't require that much space to land. You like to have 3,000 feet, but 2,000 feet is pretty good. And so this was a runway that was over 8,000 feet long. So we had one person kind of landing at the front, one person in the back, and the last person touched down before the first person left, so it's kind of a formation flight. Only do this if you're really comfortable with doing it. You could always decline and say no, and make sure that you are definitely in communication, very good weather, and you only do this if it is a safe thing to do. You're in charge as the pilot of command-- pilot in command, PIC of deciding whether it's a safe thing to do or not.

There are also restrictions about aircraft speed, and the joke here is that if you're flying an SR-71, you would actually stall even at 250 knots, so you can fly as fast as you want pretty much.

OK, so landing at an airport. We discussed a little bit about the runways and the runway headings. And so I think it's-- just in terms of how did they number that runway-- so what does runway 36 mean? Well, it's really referring to 360 or pointing north, but it's rounded. So in here, it was actually 358, but they rounded it up to runway 36. And every now and again they update these, so you might see an airport change its heading number because it's that magnetic heading.

If there are more than one runways that are parallel, then they can say left. So Runway 21 Left or Runway 21 Right or C for Center. Or if they have four runways, they'll usually just pretend that one's at a slightly different degree than the other ones, so that one side will be Runway 6 Left and 6 Right and then 7 Left and 7 Right, you know they're all basically parallel.

So there are a lot of different runway markings. These kind of arrows here talk about a displaced threshold. So what are the restrictions there? So you can feel free to taxi and take off on that space, but you're not supposed to land. So you're supposed to cross that big solid white line before you land right here. So there are a ton of different runway markings. Again, I encourage you, even when you're on a commercial flight, to keep your head out the window looking at all the different lines that you see so you can leave the runway threshold, you can see the number of the runway that's written there, and then there are different stripes that indicate how far down you are-- 1,000 feet, every 500 feet, for example.

We talked about the X. What does the X mean?

**AUDIENCE:** Closed.

**TINA**  
**SRIVASTRAVA:** Closed. Don't land there. The runway is closed. So all of these are kind of defined in the PHAK, the Pilot's Handbook of Aeronautical Knowledge. So I would kind of refresh them. Some of them were not very common. One thing here is that windsocks, windsocks are great. There are different kinds of windsocks that basically tells you which direction the wind is blowing in. When it's a very windy day or gusty day, it's very important to look at a windsock, because even though it will tell you-- for example, if you hear on the ADS that the winds are 10 gusting 25, that means that the winds are 10 knots, but sometimes a gust up to 25 knots.

And a gust can kind of change direction. So it's very important to know this, and so you might want to be looking at a windsock as you're coming in or as you're leaving the runway, and you want to know which direction the wind's going and how much is it changing, moving about, so

that when you come in, you're prepared for that as you land. There are other types of wind indicators that are pretty uncommon. I doubt that you'll encounter them, but we've shown them here.

There's also-- so the best way to fly is really looking out the window and looking at what the runway looks like. It's the picture of the runway. So look at it, see what it looks like, that's the best way. But there's some things that might trip you up, like if runways are wider or narrower than you're used to or longer or shorter than you're used to, then it might appear to be in a different place than it is. So it's always good to have an indicator as a backup. So there are different glide-slope indicators.

So a VASI is one where there are these four little lights-- you basically see them as four lights. And if you're too low, they're red, and if you're too high, they're all white, but if you're right on them about 1,000 feet down the runway-- so you basically use these as you're coming in, but once you can really see the runway out the window yourself, you look out the window, not at-- and you look at the runway, not at the these glide-slope indicators as you get close.

So another variation is a PAPI. So I like to think, again, with these memory things, VASI I think verticals, so that's why they're-- some are on top and some at the bottom. A PAPI is the same thing, but it's horizontal. There also apparently exists a tri-color visual approach slope indicator. Almost no one uses this and you probably will never see it. Same with this one. But they exist, supposedly.

OK, so we'll focus on things you might actually hear. So land and hold short. So we just talked about this. Who remembers what land and hold short means? Yes?

**AUDIENCE:**

Land, but don't cross the runway until you're given permission.

**TINA**

Absolutely. So you can land, but don't cross the intersecting runway unless you're given

**SRIVASTRAVA:**

permission. So land and hold short is something that the air traffic controller might ask you to do, and they might be really assertive about it and they might tell you, we have a lot of traffic here, I need you to land and hold short. Regardless of how assertively they tell you that, you're the pilot in command and you can just-- you can just say no and they have to deal with it. So especially if you're a new pilot, you're actually not allowed to accept a land and hold short instruction as a student pilot. So if you're a student pilot, they tell you to land and hold short, you have to say no. And the reason is that you may not be very good at it and you might take more runway than you thought you were going to take in order to land. Do you have a

question? No? OK.

And yeah. So you also have to have proper visibility in order to accept this type of restriction as well. Yes?

**AUDIENCE:** What happens if you accept? Or do you have to go around?

**TINA**  
**SRIVASTRAVA:** It's OK to accept you have to go around, you just have to-- you do what's safe for you first, for your plane, and then you communicate that as quickly as possible to the air traffic controller. If you-- as soon as you know that you might have to go around, you need to communicate that so that they can try to make sure that there's no incident with the other aircraft.

But generally, you don't want to accept a land and hold short unless you're very comfortable with the environment, it's a good weather condition, you have a good handle of your aircraft, your air speed's doing what you want it to do, and you feel comfortable that you could actually follow that guidance. But of course, at the end of the day, you're the pilot in command, and if it's going to be unsafe to you and your aircraft to make a landing and you have to do a go-around, you have to do that, and you just need to communicate as quickly as possible to the air traffic controller.

So there's some light signals. Again, no one's probably ever encountered this in real life, but supposedly if your radio dies and you need to communicate with the tower, they have this light gun and they can communicate a bunch of information to you via these signals. They're great candidates for FAA questions, they're unlikely to be used in reality, and a lot of people have their checklist. It has like a page in the back that has this because it's so rare, people don't usually commit this to memory.

So here's some more resources for you to refer to. All right, are there any questions?

**PHILIP** I don't you have questions in conjunction with a coffee break.

**GREENSPUN:**

**TINA** All right. So it's--

**SRIVASTRAVA:**

**PHILIP** I'm up next, and I figured-- I already saw people sleeping through my last one, so I decided to  
**GREENSPUN:** get two boxes of coffee.

**TINA**

All right. It's 2:15, so we'll start up again at 2:30.

**SRIVASTRAVA:**