

PHILIP

All right, folks, before Tina is going to talk, I'm going to share with you something that I've never said to anyone before in 55 years. I figured it out on my own by thinking. So when you put in the flaps, the airplane's nose has to go down.

GREENSPUN:

So you put in the flaps, nose goes down. Think about the tail plane. Remember, a tail plane is actually flying in the downward direction. So the angle of attack of the tail is negative.

And if you put the airplane a little bit more nose down, that increases the angle of attack on the horizontal stabilizer. And it can become a stalling angle of attack if that horizontal stabilizer has been rendered inefficient by frost. Does that make sense?

So remember, the angle of attack of the wing is positive between the relative wind and the wing. But the tail plane is flying down, generating lift in a downward direction. Wings pull up, tail pushes down in a conventional airplane.

And when you go a little bit more nose down, then you have a higher angle of attack on the tail. If that becomes a stalling angle of attack, it's not generating the necessary down force anymore. So the airplane stalls. Does that makes sense?

Francis says, yes. He's awake. All right, well, anyway, thank you guys for being here for that unusual moment in my personal journey.

TINA P.

SRIVASTAVA:

All right, now, we're going to jump into radar, and communications, flight information. And we're going to do a little thing that you probably haven't done for a long time, especially not here at MIT. We're going to sing the alphabet together. So it's going to be a great session.

So we'll start with radar and Air Traffic Control, or ATC services. So what's a transponder? Why do we have transponders? What does it have to do with anything?

So a transponder is something that helps enhance your radar return, so that the air traffic controller can better understand where your airplane is. So who knows just generally what a radar is?

Let's step back. Do people know what radar is? Who's seen the movie or read the book *Hunt for Red October*?

Goodness, only half the class, that's really a shame. In that situation, we're talking about sonar. But sonar, since it's audible, is much easier sometimes to think about.

Well, in that movie, we have some of the characters that are in a submarine. And they're trying to find another submarine. So they send out a sound, a sonar that goes out and is supposed to bounce off of whatever is out there and come back.

So if there's a submarine, it will bounce off. So you hear, you know, ping. And then if it comes back, they can hear the sound coming back.

Well, radar works the same way, but it's above the water. And we use radar to detect aircraft. So the air traffic control center has a radar that basically sends out signals that bounce off of airplanes and come back.

We also can use radar for other things, like terrain avoidance, so very complex airplanes. Not usually your little Cessnas, but some more complex airplanes might have a terrain avoidance radar system. So as they're flying along, they send out a signal. It bounces off a mountain and comes back, and it tells you there's a mountain over there.

Well, we want to make sure that that return, so the signal bouncing off, is very clear and provides as much information as possible, so that the air traffic controller knows where you are and what aircraft you are. So inside-- yes.

AUDIENCE: I think it's important that we all realize [INAUDIBLE] invented right where we're sitting right now. Do you know that?

TINA P. SRIVASTAVA: Yeah, that's a really good point, so just remembering where we are here at MIT and that radar was, in fact, invented here at MIT. It's a very good point.

AUDIENCE: [INAUDIBLE] this building.

AUDIENCE: Well, [INAUDIBLE].

AUDIENCE: This building used to be army barracks. And because radar was invented there, MIT had to keep the army barracks as a historic site. And there were, like, wood floors. And I had classes in there.

It used to be the MIT model [INAUDIBLE]. And they finally got permission to demolish the Army barracks to build this building. So it really was right here.

TINA P.

Oh, wow. That's great, so a little history about what was here before this data center was built

SRIVASTAVA:

here. That's really great, thanks.

So with that great history about where we are and radar, a transponder is actually a piece of equipment that you have in your aircraft. And this is generally what it looks like. So it has some numbers across the bottom where you can type in a particular transponder code or a squawk code, as it's called.

And there are different types. When we were talking about the charts and airspace, we discussed how near the class bravo we had a big ring around the side that said mode C transponder. So it required a specific type of transponder, so that the air traffic controllers know exactly what the altitude is of your aircraft.

There are a bunch of different squawk codes. One that is probably the most important for you to remember is a 1200. So that is the VFR or visual flight squawk code.

So if you don't have a particular flight plan going on, you'll need this squawk code dialed in almost all the time. And this is usually a question on the FAA exam you know, if you're a VFR flight, and then they add a bunch of other things to the question. But if you're VFR flight and you don't have a specific flight plan, or flight tracking happening, then you should be on that 1200 squawk code.

There are also a couple other ones. Hopefully, you won't have to deal with this in a small, you know, two-seater or four-seater airplane. But in case you get hijacked, you need to enter a particular squawk code, 7500.

Seriously, please don't enter this unless you mean it. You might find yourself entering this. You might hear someone not actually say the word hijack. Maybe they don't want your person hijacking you to know that that's happening. And they might just say, confirm transponder squawk code 7500. And if you confirm, that means you've been hijacked. You might see a special plane come fly up next to you or something bad happen. So please only use this if necessary.

Lost comms is really important, 7600. So if you indicate that, it might be the case that your transponder is working even if your radios, for example, are not working. So by indicating this, that would be how you tell the air traffic controller, for example, the tower controller at your airport, that, hey, I don't have radio comms. And that's when they would use that light gun

signal, as we discussed the different colors, to indicate different instructions to you.

And then in general, if there's just an emergency, if you've lost your engine, if you're declaring an emergency, 7700 is a great one to just indicate to everyone that you're in trouble. So don't accidentally dial in these squawk codes. Please be very mindful of these in particular. And in general, there's also an FAA question that comes up that says, you know, what's a squawk code you don't want to dial in accidentally? And those are those three at the bottom.

So let's just take a step back and talk about this. In general, when I first became a pilot before I learned all this material, I was under the impression that you pretty much always had to have a flight plan. That before you flew anywhere, you had to decide where you were going.

You had to file a flight plan. You had to communicate to different people and tell them that this is where you were going to go and get it approved. And then when you took off, you had to fly exactly that flight plan.

Well, turns out that's not always the case. And in fact, that's only usually the case on specific types of flights or an instrument flight, for example. But most of the time in general aviation on a good weather day you don't have to file a flight plan. And most of the time most people don't file a flight plan.

You can even decide what you're doing after you've taken off. It's a good idea to know in advance generally where you're flying, because you need to know certain of those required things we talked about-- airports in the vicinity, fuel, runway length. But if you always fly kind of in your home airport area, so if you fly here at Lawrence, or you fly out of Bedford, Beverly, one of the local airports and you're familiar with all the airports in the area, when you take off on a given day you don't necessarily have to tell anyone in advance where you're going.

You might go with an instructor. And that instructor, kind of as you're flying, will decide, you know, we should do a couple landings at Worcester. We should practice an instrument approach at Lawrence or whatever they're deciding in the air.

And so you don't have to file these flight plans. So when you're in the air there are certain times that you don't actually have to talk to anyone. And we discussed the different classes of airspace. So as long as you're not in a class of airspace where you have to be specifically communicating, you can actually just take off without a lot of communication equipment and just look outside the airplane to avoid aircraft and go where you're going.

But if you do want to have some guidance-- so let's say you're flying somewhere you're not in a class bravo or a class Charlie airspace. But you know, say you're just taking a flight. You want to go south to Provincetown, let's say.

And while you're flying, you just want to have an additional pair of eyes in the sky to help you know if there's a really bad quick changing weather front coming in that maybe developed that you didn't notice before you took off, which usually-- we'll talk about weather data. Hopefully, you'll know in advance. Or you just want to be aware and alerted to other traffic in the area, traffic meaning other airplanes flying in the area.

So you can actually choose as a voluntary thing to call in and ask the air traffic controllers to give you those traffic advisories. And there are different types of services available in different areas. There are even parts of the country where it's not available at all. So even if you wanted to have someone to talk to you when you're flying up there to tell you what's going on, there is no radar service in all parts of the country.

So how do you request the service? So you can do it a couple of ways depending on where you are. Sometimes when you're still on the ground before you've taken off, you're taxiing or you're in the run up area, you can ask for certain types of flight services.

But a lot of times, it's after you've taken off from the airport, after you have left the tower controller. And you've switched to a local radar. And you want to ask for some types of radar following.

So in general, whenever you do a radio call, you start with who you're talking to. So in this case, Boston Approach. So Boston Approach is who you're talking to.

And then who you are-- so in this example Cirrus 707 whiskey tango. So that's the name of the airplane that you're in and the tail number. And then you have to say where you are, so they can try to find you.

So you can say 5 south of Hanscom. So that means you're 5 miles south of Hanscom or Bedford field. And then what you want, why you're calling-- so requesting VFR advisories, Provincetown.

So that's saying kind of where you're going and what you're asking for help with. So once you do that and, first of all, before you call in, you want to listen to the radio for just a moment to

make sure you don't talk over somebody. But once you make that call, you're waiting for the approach controller to call you back.

And so if they call you back, they'll say who they're talking to first. So that's you, so seven Whiskey Tango. And then they'll tell you what to do, squawk 4231.

So that means to type into your transponder the numbers 4231. And ident, so ident is short for identify. And there's an ident button on your transponder. When you hit ident, it basically blinks on their screen to make them find you easier with all the airplanes on their screen.

OK. And it's also possible that you call the controller, and you don't hear any response. Maybe they're busy doing some other thing. So you give them a little bit of time. You can just make your call again and hope that they respond to you.

And once the controller tells you, you know, radar contact, so that's where they say that they found you on their screen. So you know, radar contact 7 miles south of the Bedford airport, that means they caught you. And in this example, as you can see, you traveled 2 miles before they actually got the radar contact. Sometimes that happens.

When you're getting traffic advisories, they do it in reference to a clock. So if you remember, you guys have to go back and remember your analog clocks. And you know, just so I do it to you guys, so you're looking here.

So you know, 1 o'clock, 2 o'clock, 3 o'clock, so basically it's like a clock. And they're trying to do it in reference to you. So when you flying the plane look at your 3 o'clock, that means look out your right window.

It just noted that wind can affect that sometimes. So even if they said 3 o'clock, it might be at 2 o'clock. So just keep that in mind.

So we'll just do a little practice question here. So here just to make it easy, we're saying the pilot is flying on a heading of 360. So why is that easy?

Well, 360 is north. And so north sometimes makes it easy to think about. So if you're flying on a heading of 360 degrees and the controller says traffic, 10 o'clock 2 miles southbound, where are you looking for this traffic? So A, B, or C? Shout it out.

AUDIENCE: A.

TINA P. All right, good. So you're flying north. And so when you're talking about traffic at 10 o'clock, so
SRIVASTAVA: 10 o'clock will be a little bit to your left. So that's the 10:00. And then 2 miles is kind of how far away that is in the direction that traffic is going. Yes.

AUDIENCE: Is that clock heading relative to you? So if you would be traveling at heading of zero, would 10 o'clock be southwest?

TINA P. Yes. So the question was, is the clock relative to you? So it is relative to you. So we just made
SRIVASTAVA: it easy by saying, you're flying 360 or north.

But yes, if you were flying south, 180, if they say 10 o'clock, it's still going to be out your left window a little bit forward. But in that direction, it's going to be now southeast. Good question.

OK. So we've already talked about this a little bit yesterday, the ATIS, or Automatic Terminal Information Service. So we talked about that when we were looking at the charts. And we talked about the ATIS frequency.

So it's a frequency you can dial in. And basically, it's information that's being broadcast. So when you dial into that particular frequency, you get a certain amount of information.

Now, the first couple times, I admit when you hear this ATIS information, it seems very overwhelming. And you might have to listen to it 3 times, 4 times even to understand what they're saying. But I trust you, it gets a lot easier over time.

So they give you a whole bunch of information. So they give you the airport name. That's really important to listen to. Maybe you dialed the frequency wrong and you're getting the ATIS information from the completely wrong airport.

So look at the airport location, and then the letter. So they'll say, you know, Bedford information whiskey. So that letter is referring to the most recent update.

So let's say you listen to it, it says information whiskey. Then you go off, you do some practice turns or whatever. And you're coming back to Bedford, and you dial it in.

If it's still information whiskey, then you don't have to listen to the whole recording. You already have that information. But if it's now advanced to the next letter, then you know it's new information. So you need to listen to it.

So a whole bunch of weather information is provided here. So it'll give you the time. We'll

explain what we mean by Zulu time, the wind, visibility, ceiling, those types of information.

It'll also tell you local information, so if a certain taxiway is closed. Or right now, you're likely to get a lot of those warnings, because there's snow everywhere. So they might have piled up snow on certain parts of the airport. So they'll indicate that those different taxiways or runways might be closed.

So in case you want to listen and practice to listening to different ATISs, this is an example. You can click on and listen to what it is. There's also a phone number that I've highlighted here.

So you can just use your regular phone. Call that number, and you can listen to the ATIS information. And it updates approximately once an hour. It can update more often, especially if weather is changing frequently.

They're also flight service stations. And there's a lot of way to get weather data. So when you're on the ground before your flight and you're preparing, you can actually get a weather briefing.

You can get a full weather briefing. It's very important to do this, especially before your FAA check ride. But also, any kind of cross-country flights, it's a good idea to call in.

And you can provide your tail number. You can indicate where your starting airport is, where your destination airport is, when you plan to take off, how long you plan to be in flight. And then that way they know what weather data to give you.

And they'll actually just tell you all the information that you need to know in a very long spiel. So you want to be ready to write all that information down. But what's really great about that is they also keep a record that you called in and that you got this weather data. And so it's one way to kind of demonstrate that you've adequately prepared for the flight and gotten the appropriate weather briefing in advance.

All right, so radio procedures, so this is where we're going to do our fun alphabet test here. So we actually did this last year, but some people said they kind of forgot the alphabet. So it wasn't that they forgot that B stood for Bravo, they just forgot what letter of the alphabet came next.

So to remove that as an excuse for you, I have the full alphabet here. And together, we're

going to see how much you know about the full aviation phonetic alphabet. So what they mean is instead of saying A, you say alpha. Instead of saying B, you say bravo.

So let's go through together. So let's start from the top-- alpha, bravo, Charlie, delta, echo, foxtrot, golf, hotel, India, Juliet, kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whiskey--

[INTERPOSING VOICES]

AUDIENCE: [INAUDIBLE]

TINA P. SRIVASTAVA: Yankee, Zulu. All right, good job. So I know that some of you aren't familiar with that, and that's totally fine.

So if you were just listening along, that's OK. It's good to just get used to hearing it. But it's a good thing to practice.

And you might notice that in your daily life, especially if you're someone like me that has a very long last name, Srivastava. I have to spell it out to people. I love to use my aviation phonetic alphabet to do that.

And you might find a fellow pilot on the other end of the line. So that's always fun to do. But it's good to just start practicing this and get used to it. Not only is it a fun trick you can whip out when you need to, but it's extremely helpful just to have that kind of memorized and be familiar with that.

In terms of the numbers, you pretty much just say the numbers. Sometimes people say niner instead of nine, some people don't. Also, instead of saying three, they say tree. A lot of people consider that pretentious, and they don't like it when you do that. But officially, you're supposed to say tree instead of three. It's supposedly easier to hear on the radios.

There's also different ways that you describe a number. So if you're talking about 1,200 feet, like your altitude, you say 1,200. But if you're over 10,000, then you say one zero thousand.

And then if you're talking about a frequency where you have a decimal point, so you would say 124.4. So it's really important to do that, because if you start saying 124.4, then you take up too much time on the radio. And people aren't used to hearing the numbers that way. It can confuse people. So just a question to make sure you've gotten that, so A, B, or C?

AUDIENCE: C.

TINA P. SRIVASTAVA: Right, so one zero thousand five hundred. There's inevitably a question on the FAA exam about this. It's not that hard to do, but please try to remember it. All right, so Zulu time is the same as the UTC time. So does anyone know what time zone we're currently in?

AUDIENCE: Eastern.

TINA P. SRIVASTAVA: Eastern. But is it Eastern Standard Time or Eastern Daylight Time?

AUDIENCE: Eastern Standard Time.

TINA P. SRIVASTAVA: Eastern Standard Time, that's right. And do you know how many hours that is different from the Zulu time?

AUDIENCE: 5.

TINA P. SRIVASTAVA: 5, right. So you subtract 5 from the Zulu time to get our Eastern Standard Time. And does it stay like that year round?

AUDIENCE: No.

TINA P. SRIVASTAVA: No. So when it turns into Daylight Time in the March time frame, then you do minus 6 or minus 4?

AUDIENCE: [INAUDIBLE]

TINA P. SRIVASTAVA: Minus 4. So it's good to just know that, because a lot of the weather data and information is provided in Zulu time. And you might need to convert it to your local time zone.

So when you're speaking on the radio, it's very important to know that that radio is for essential purposes. You know, it needs to be available if somebody is having an emergency, if somebody is lost or disoriented, if somebody is having a problem. So you don't just speak and talk on the radio unless you have something in particular to say. That logic goes out the door if you're at a very tiny, not very often used airport.

The other thing to keep in mind is that a lot of the communication radios operate at a VHF, or Very High Frequency, which means that it's line of sight. So if there's a mountain range in

between you and what's transmitting, then you won't be able to hear that connection. So there are a number of airports in the Northeast that are kind of nestled in between some mountains.

You've got to be very careful of mountains. Philip talked a lot about fog associated with mountains and different wind effects near mountains. So mountains are not something to be trifled with. But in addition, you may not have proper radio communications. So if you're trying to land at an airport in the mountains, you may not be able to get the ATIS unless you fly high enough that you have a line of sight to that airport above the mountains, for example.

And then whenever you're using the radio-- we already briefly covered this with one example. But there are a couple things you need to say. So you need to say you, so who am I talking to, first.

And then who I am, where I am, what I want, and then sometimes you have to say with, with meaning what information you have with you. And that's referring to the ATIS. So if you are trying to take off from Hanscom Airport and you have received the ATIS information whiskey, then you say with whiskey.

Because if you don't say whiskey, then they might not know if you have the right barometric pressure setting, for example. Or you might not know that an airport runway is closed. So they want to make sure you have the right information.

So this is an example. So first, whenever you get on the radio, don't just start talking. First, listen to make sure you're not talking over anybody. And then state all that type of information.

So in this particular example, it's a Cessna coming back to Hanscom to land there. So you would say, you're talking to Hanscom Tower. So you would say, Hanscom Tower, Skyhawk November five three five six niner, 5 miles west of the field. Field is referring to the airport. Inbound for landing, so that's what I want, with information whiskey.

And one thing to keep in mind with all radio communications, you are the pilot in command. It's important that you first aviate, which is fly the plane. Then navigate, make sure you know where you're going. And last, communicate.

That's really important, because sometimes there can be a very aggressive air traffic controller on the phone trying to get you to respond or, even if you've declared an emergency, trying to help you. And if you need to tell them to stand by, if you even need to unplug your communications so that you can focus on landing the plane, you should do that. Because

aviate is most important, then navigate, and finally communicate.

And if the air traffic controller gives you any instruction regardless of how assertively they tell you to do something, you can just say, unable. That means you're not going to do it. They have to figure out a way around it. They have to either move other planes out of the way. And you're telling them what you're doing.

So in the unfortunate case of the-- ultimately positive case of Captain Sully landing in the Hudson, if you watch the movie or if you hear the recordings of that, you hear that the air traffic controller is trying to be really helpful and is trying to say, hey, you can land at Teterboro. You know, I've cleared all these airports for you. And Captain Sully just says, unable.

So there's a Common Traffic Advisory Frequency, or CTAF. So this is where there are a lot of airports increasingly, unfortunately due to budget cuts, there are more and more airports that don't have operating control towers. So in these spaces, you have a frequency that airplanes can just talk to each other on to make sure they're coordinating with other people there.

So I'm going to give you a couple examples and procedures. So you want to do your first call 10 miles away from the airport and then just report certain things. So when you're entering the downwind, the base, the final, these are the legs of the traffic pattern to land.

When you're leaving, also when you're taxiing on the field, those are things that you would want to call out on the radio. And nobody will respond to you. Sometimes you just say that, so that anyone who's around who might be in the vicinity can hear that there's another airplane and what you're doing.

And so just kind of tying it back to when we're looking at the charts, so here's a snapshot from a sectional chart. So you see in the middle there there's a tiny little airport. It says, Jamestown.

So if you want to figure out what the CTAF is, so just zooming in there, so you can see where it says in magenta Jamestown. It talks about the airport. It first gives the ASOS, which is the automated weather information. It gives you more information there that it's the bottom right numbers 123.0 is that CTAF. So that's the frequency at which you would just announce that you're coming in, that you're landing, et cetera.

So there are a lot of different radar facilities. You may not necessarily interact with all of these

as a private pilot, but there are things called clearance delivery. They're really frequently at busy airports. And they talk about a lot of specific operations. You probably won't deal with this much as a private pilot just getting your first license.

Ground control you'll definitely talk to if you're at Hanscom, even at Lawrence. There's usually both a tower and ground. And so when you're ready to enter the runway, so you finished your engine run up, you're lined up waiting to enter the runway, that's when you talk to tower.

You tell them that you want to take off, and then they give you clearance to take off. And when you're flying and approaching the airport, you're talking to tower. But once you've landed and you exit the active runway, then you switch over to ground. And ground will tell you how to taxi around the runway and get to wherever you're parking your airplane.

So if you lose your communications, the first thing you should do is actually make sure you did lose your communications. It turns out vast majority of the time you actually just bumped your plug out of the socket, and you just need to plug it in. Or you turned your volume down.

Or you're not talking on the right frequency. So make sure all of that's working, because it's very infrequent that your comms actually die. But if they do, we've talked about how you can enter that transponder code and indicate that you don't have your comms available.

And we talked about that that transponder code is 7600. So that's the last communications. And depending on the class of airspace, they might give you a light gun signals to tell you what to do.

Or you could actually just go to an untowered airport where you don't require communications with anyone, and you can and just kind of look around, see and avoid other aircraft, and land. You can also transmit in case it's the fact that your ability to hear has died, but your ability to transmit is still alive. So you can still transmit, you know, I'm approaching such and such airport. I'm entering the final.

But don't continuously transmit. Because keep in mind it might be that your transmission is working just great, you just can't hear. So don't clog up the entire radio. This is just a review of those light gun signals as well.

OK, so emergency procedures, there are a lot of different emergency procedures, but here we're focusing on from our radios and comms perspective. Again, you need to first aviate, then navigate, then communicate. So the first things you do really depends on what the

emergency is, right?

If it's an engine failure, then your focus is on pitching to an appropriate airspeed, so that you can get the greatest time and distance to where you need to land, finding a place to land and trying to restart your engine. That aside, with regard to the radios and the communications, there is an emergency frequency, 121.5. There's a squawk code, 7700.

We already talked about that. And you can radio just mayday, mayday, mayday. That alerts folks of the fact that you have an emergency.

We also discussed when we were talking about required equipment on your aircraft, there's a such thing called an ELT, or Emergency Locator Transmitter. And this thing basically turns on by itself and will basically broadcast where you are. And it needs to be tested fairly often. You can actually tune into the frequency that it's emitting at to test if it is transmitting.

OK, flight information, this is our last big section. So this is talking about information around an airport. So I'm going to grab the ForeFlight again. So again, just like with the case of the sectional, there's always a physical version or an electronic version.

So the picture you see on the slide is something that you could actually look at. So there's an airport flight directory. So that will give you the types of information you're looking at. Or on a ForeFlight, and I'll pass this around, you can search a particular airport and get the same information. So I'll just pass this around.

So there's a lot of good information. We already discussed some of it when we were first talking about charts and runway markings and runway length and those types of things. But from a communications perspective, it also has a lot of great information with regard to what the ATIS is, what the tower frequency is, what the ground, all of that type of information.

And we've also discussed previously the FAR/AIM very large book of regulations. There are a number of other types of notices called Notices to Airmen, or NOTAMs. And NOTAMs basically can be warnings of different types of things.

We've discussed a TFRs or temporary flight restrictions. But you might also get a NOTAM that there's parachute jumping in the area. So watch out for that happening.

Sometimes there's also an advisory circular. These are not required or binding, but information that is put out to help you understand or clarify if there's confusion with

regulations.

OK, I have the answer up here for you, but just a couple practice questions. So this one is about basic radar service. And so this is about what we were just describing. If you call up and ask for flight following, what are they providing you?

Well, they're providing you safety alerts, traffic advisories. Sometimes they'll do vectoring. So what do I mean by vectoring is let's say there's traffic, traffic 12 o'clock 3 miles.

That means there's traffic right in front of you 3 miles away. And then they come back. And you know, you're saying, looking for traffic. You can't find the traffic.

They say traffic 12 o'clock 2 miles in the same altitude as you. So if you're at 3,000, they say 3,000. And then you still can't see it.

And you're just like, you know, negative traffic. So then they'll just tell you. You know, they'll just give you another heading.

So they'll give you a number, so heading 360. Or they'll say, turn 10 degrees left. And so that is what they mean by limited vectoring. So they'll tell you what to do for a little bit to avoid something dangerous.