

**PHILIP**

**GREENSPUN:**

All right. So I remembered something that a physicist told me about gyroscopic precession, which I want to share with you. He said, basically, angular momentum is always thought of as a vector. So if you have, for example, a helicopter rotor system, you curl your fingers in the direction of the rotation. And then, your thumb pointing up is the vector that represents the angular momentum.

So if, for example, you push up at the back of the rotor disk, that's like a turn in this direction. So now you have a vector going this way, and the new angular momentum is some kind of sum of those two, so the sideways vector and the up vector, maybe a little bit like this. And the new rotation of the disk ends up looking this way. So that's the gyroscopic precession. The new arc looks like it's been pushed up from a point 90 degrees more advanced than the disk.

So if you can remember that-- so I guess, for the airplane propeller, let's say we could do-- it's rotating this way, clockwise. Rotating this way, so the vector is going out. If we push on the side, that's like rotating this direction, so it's up. So the sum is a little bit up like this as if it's been pushed from the bottom.

Be glad you're not a physics major, I guess, if you don't like that. MIT used to require two years of physics. Uh-oh. The clicker is not working. Oh, maybe it is. "O ye of little faith."

All right, flight planning-- so let's stick with the same challenge that we looked at before, which is getting to Bennington, Vermont. So you have a sectional chart and you can draw a line. I did this with SkyVector. I want to prove to you that it can be done.

So we basically say, look, we want to go from Bedford, which is here. We put our ruler on the chart. It almost goes to Bennington over here. Do you see that Moore state on the chart? And you can see the ruler is good for about 88 nautical miles, so it doesn't quite stretch to the 90, but it can be done. And you can also see this protractor here. We can get some idea if we kind of slide it up and down the line until we get a line of longitude. We can eventually see, OK, it's a true course of 28 something, it looks like.

All right. We'll figure that out using electronic tools, but I just wanted to show you that it can be done. So the key is, here, you are making sure that the-- you know, you'll draw this out with a pencil and continue the line. And then, for the protractor part, you make sure you put it on one of these lines of constant latitude or longitude, which gives you an accurate reference to true

east-west or true north-south.

So the tools-- as you just saw, the classical tools for this are the New York sectional chart, which I brought, that plotter, essentially the ruler and protractor combined, the E6B calculator which we played around with a little bit yesterday. What's the plan for our plan though?

We want to make sure that we're going to find an altitude that doesn't interfere with terrain or with which terrain won't interfere. We want to make sure that we're not going through restricted airspace that's active. Or if we are going through a Class Charlie airspace or Class Bravo airspace that we're aware of that in advance so we can make sure to be in contact with air traffic control.

A lot of cross-country flights, basically all of mine, I call up air traffic control anyway and request VFR advisories. It's an optional service. But that way, you're pretty unlikely to blunder into airspace that you shouldn't be in. We're going to check-- and actually, that reminds me of something, a comment.

You know, this ground school stuff, I think it turns some people off of flying, per se. The people who are really interested in the stick and rudder stuff, they say, you know, god, I don't want to learn about all that airspace. I don't want to deal with all those air traffic controllers. I just want to fly.

That kind of flying is hard to do at Hanscom Field, which is the ninth busiest airport in the northeast after airports such as Logan and LaGuardia and JFK, but it's very easy to do in a lot of parts of the country. You know, if you're out west, most airports-- you have thousands of airports in the US that don't have control towers, that don't have any traffic, that are surrounded by Class G airspace. You do whatever you want.

So that kind of flying exists. To get to private, the FA wants to make sure that you've at least learned this stuff so, if you become that kind of a backwoods pilot, that you don't blunder into JFK Class Bravo airspace. But that kind of fun flying does exist. The other thing I wanted to say is, in all kinds of flying education, there's an emphasis on the hazardous. You saw some of that, I think, yesterday with Mark.

He talked-- you've got to do this. You've got to scan for this because you don't want to have a midair collision. Midair collisions or 1% of accidents last year according to the Nall Report. If you're interested in these statistics, the AOPA Safety Foundation ASF, or Air Safety Institute, I

guess, they have this thing called a Nall Report, N-A-L-L. Every year, they analyze all the kinds of accidents that have occurred. But midair collisions are exceptionally rare, like I said, 1% of accidents, maybe 3% of fatal accidents.

So flying tends to be pretty forgiving. Usually, most people who have an accident have made three or four mistakes. It's not like one little mistake is going to generally get you into trouble. So I don't want people to think that it's all bureaucracy and regulations all the time when you're up in the air, or that, at any moment, the airplane could suddenly stall and spin, that kind of stuff. It's just extremely rare. If you're flying a Cirrus, you're nowhere near the stall in any phase of flight as long as you're doing things more or less by the book.

OK. So anyway, this is our plan, and we'll follow this kind of step by step. OK. So if we look at the sectional chart, we can see that there's these-- see that 41? That tells you that, if you're at 4,100 feet, you have a little bit of clearance from the terrain, not enough for flying on instruments, but enough for flying visually.

We can also see the only real airspace that's on our route is the Class Bravo airspace itself, and that goes from 4,000 feet up to 7,000 feet over top of Hanscom Field. So as long as we're in contact with Hanscom tower and we're not climbing in some kind of fighter jet, we're going to be clear of Bravo airspace. And also, if we have a plane with a GPS VOR receiver combined and part of it fails, you can see there's all these VORs around here, including one very close to the airport that we're going to.

So we're not going to get lost, even if we can't find Venus like Captain Sully, can't talk to air traffic control, and can't use our GPS, and can't look out the window. Actually, a lot of times, we send soloing students to Keene, New Hampshire because it's right next to Mount Monadnock. And we figure, well, they probably can't get lost if there's only one big mountain sticking up by itself right next to the airport.

All right. It's always good to have a plan. What if you cross the mountains and the airport is hard to find, if the airport is covered in some fog, if somebody has driven a huge lawnmower onto the middle of the runway and gotten stuck, what do we do? So it's always good to have a backup plan. Here's Albany. Remember I told you that story about the Cirrus hero.

So he wanted to go here, to Rensselaer, RPI, and here's the huge Albany airport with a wonderful FBO. It's very inexpensive, cheaper than Hanscom actually for fuel. And here's the airport that he was thinking about. See it says that it's a 2,700-foot runway, but due to the

displaced thresholds, it's actually shorter. That doesn't have a control tower. That C means it's a common traffic advisory frequency. Albany, of course, is a Class Charlie airport, so it has all kinds of great services.

Anyway, so for our alternate, if things aren't going well, I want to be drinking free coffee at the FBO and borrowing the crew car and going to a nearby restaurant, not standing out there in the wind, wondering why nobody's at the Rensselaer County Airport.

OK, so we found an alternate airport, not required unless you're IFR, but always good to think about. Another reasonable alternate for Bennington would be just to make a U-turn and go back to Hanscom because it's not really all that far.

All right. We can look at the chart supplement for Bedford if that's not our home airport. Remember, this gives all the information about radio frequencies and runways. Similarly for Bennington, Vermont, we can see it's a 3,700-foot runway.

Not too much else that's interesting here except, if it's going to be nighttime, it says the lights won't be on. We should activate the medium intensity runway lights on the CTAF frequency. So if we click the microphone five times, all the airport lights will come on. That'll be nice. Otherwise, not too exciting. Looks like this runway is slightly sloped. That's one thing about Vermont. See it says 0.9% slope up, so that's going to have a slight effect on our performance.

OK. So in the old days, we would just call this 1-800 number and get our weather briefing. Or if we were en route, we might call-- you can see Bridgeport radio is available here on the VOR. The VOR for Providence indicates that, if you want to talk to Bridgeport radio, you call them on 122.6, so we can also talk to Bridgeport radio. Although, if we're going to do a flight plan, we want to get most of our stuff done beforehand.

We can look at our AIRMETs. This is an older slide. This is not current data, but at least, at some time, there was an AIRMET for IFR and Mountain Obscuration. So in that case, we might consider deferring our flight. There was also AIRMET Tango for turbulence. So look at this. Is it time to freak out? Well, it says moderate turbulence. They used to always say occasional moderate. Now they don't put the occasional in there.

But really, that means there may be turbulence below 8,000 feet. Usually, once you get about through half of the turbulence forecast altitude, it smooths out considerably. So if it says, as I mentioned yesterday, the turbulence forecast goes up into the flight levels, it's a pretty ugly

day. If it goes up to 8,000 feet, that's kind of a standard slightly windy New England day. All right. And you know, you might get a few bumps climbing up to 4,000 or 5,000.

METARs-- you get this list of METARs. So as I said yesterday, once you get used to reading these, this is actually-- I prefer this format. It's very compact. You can just zip down. We can just assume these are along our route of flight if we get them in our briefing format. So we can see, oh, it's gusting 19 knots. It's a gusty day. When we get to Bennington, it's 300 at 5 knots, 10 miles broken 7,000. That's pretty reasonable.

Terminal forecasts-- you heard about that yesterday. But again, we get them from the briefer or the briefing format along our route of flight. Remember our goal is to maintain VFR weather minimums. Again, you can see how much more challenging this is than in a jet.

If you were in a jet, you would say, well, I don't need to maintain VFR because I'll file IFR, and I don't need to remain clear of icing because I can turn on the icing unless it's incredibly severe. But you guys will have this challenge, at least until you decide that you want to get your instrument rating or you want to bring along a co-pilot who's instrument rated.

Winds aloft is very important for this flight or for this flight planning task. We can see Boston. Albany winds might be the best. So the winds are coming from 330, more or less in our face at 28 knots. And the temperature outside is minus 10. So if it is cloudy, that means there's a risk of icing. So in a Piper Warrior or Cirrus, I wouldn't do this trip on this day unless I thought that I could remain clear of the clouds due to that-- you know, if you saw that, at 6,000 feet, it was above zero, that would be great.

OK, relevant NOTAMs-- the VASI. See that on the bottom? The VASI at DDH is out of service. So that means we're not going to have our visual reference for the glide slope to the runway. If it's your home airport, that's not a big deal. If it's daytime at an unfamiliar airport, that's not a huge deal. Nighttime at an unfamiliar airport, that's kind of a problem. So you might consider, at nighttime, it's better to treat that like instrument flight. You might not want to go.

Actually, in my airline days, we got to this airport at night. We were really delayed for a variety of reasons. But anyway, we get to this airport in Michigan at night, and I'm flying left traffic from the right seat, so I can't really see the airport that well, in this Canadair Regional Jet which I've just barely learned to fly, exclusively in the sim. The first flight in the real aircraft was with passengers in the back.

And the runway's under construction, so the instrument landing system which gives you the glide slope reference, that's out of service because it would lead you to a part of the runway that's closed. And the VASI and PAPI that are normally there at this big airport in Saginaw or wherever it was, that's also out of service. So it's just a pure visual approach based on the configuration of the runway lights and the geometry and how it looks, just like you are flying a Cessna or a Piper in this jet. So we got on the ground, and like I said, I'm piloting from the right seat.

I should, perhaps, have just turned it over to the captain and said this is a little beyond my skill level. But I wanted the practice, so I did it. And we turned off the runway, and nobody was more surprised than I when we were on the ramp, safe and sound. We got out of the airplane and this passenger was irate. He thought somehow it was my fault. He saw me having dinner with a friend at the terminal.

He thought I was the reason for the delay, that the flight was held up for my dinner, and he was enraged. And I thought to myself, this guy has no idea how lucky he is to be alive with somebody like me at the controls with no visual references of any kind, the first time at that airport, going-- 145 knots was the slowest speed that we were going at any time.

**AUDIENCE:** Sorry. So a question on-- just the one VASI is out, right? So is there a circumstance, like if the winds were calm, you could say, OK, won't land on 31, I'll land the other way?

**PHILIP** On the other runway? You don't want to land with a tailwind in general, and there may not be--  
**GREENSPUN:** we could go back, but there may not be a VASI on the other side.

**AUDIENCE:** Oh, OK.

**PHILIP** Usually, airports have sort of one runway that they really love. Actually, that's interesting. First  
**GREENSPUN:** of all, they don't even have a VASI. They have a PAPI on both sides. So yeah, actually, that's a good example of decision making. If the wind's not too bad-- and actually, at nighttime, the wind usually quiets down. So yeah, perfect example of good decision making. Just use the other runway. Why not?

All right. So we used the plotter. You saw some of that. We draw our line. You can see there we're referencing the plotter to true north and we get-- well, this is not for the Bennington example, unfortunately. We get a true course of 038 to some other airport. Here's what I did want to show you. You find some prominent landmarks along the route. We talked about that

yesterday in the piloted section, so things you can identify from the air.

You get your blank navigation log form. You pick an altitude. So this is one reason why midair collisions are exceedingly rare. If people are above 3,000 feet above the ground, higher than 3,000 feet above the ground, then you get up to your conventional cruising altitude.

So if you're on instruments, it's going to be whole thousands. So you'll fly on instruments at 6,000, 8,000, for example, if you're on a westbound course. And you'll fly 5,000, 7,000, 9,000 if you're eastbound. And then just add 500 if you're VFR. So airplanes at low altitudes that are cruising are almost always separated by 500 feet. And therefore, the conflicts tend to occur very near airports, and the conflicts also tend to occur-- there's one exception to that rule.

On days when there is a low cloud layer like at 3,000 feet, for example, or 2,500 feet and everybody who is VFR is trying to go under the clouds, that's when you might see other airplanes and have to be vigilant. But again, you can call air traffic control and ask for advisories. Or now, by January 1 of 2020, everybody will have a ADS-B so they have a box in there that's squawking at you.

Let me tell you that, when you land at Burning Man, your fancy traffic warning system will get very upset indeed. We had warnings. Burning Man has this-- it's not like Oshkosh. It's super well-organized. They have people converging, by design, from three different directions to a single point, flying a pattern that's 500 feet above the runway instead of the conventional 1,000 or 1,500 for turbine-powered aircraft. And then you're landing on a place that's not normally considered a runway.

So in the Pilatus, we had the terrain warning system going nuts because it didn't know that there was a runway there. And we also had the traffic system going nuts because we didn't have ADS-B but we had enough transponder-equipped aircraft around us that it could see them all. So that was pretty upsetting. Not as upset as the cool Burning Man people were to see me, but my friend had a good time.

**AUDIENCE:** [INAUDIBLE] what does that mean if you have [INAUDIBLE], like if there could be a situation but there is none?

**PHILIP** Yeah, this slide should really contain that exception, that it's only up to 3,000 above the-- it's  
**GREENSPUN:** 3,001 feet above the ground and above. So the question was, what if you have low clouds? How can you do this? The answer is, if you're 3,000 feet and below, these conventional

cruising altitudes don't apply. OK. Oh, yeah, so this is just an elaboration of that.

So we're going to be on a magnetic course that's generally westbound, so we'll pick 4,500 feet. Do we need oxygen for our flight? The answer is no. That's a good thing. If you are going to be flying above 10,000 feet though, if you were doing a charter flight, you would need oxygen.

So you might ask yourself, well, if it's good for the charter crowd, why isn't it good for me? I do think that it-- especially as you get older, people tend to get a lot more sharp if they keep the cabin altitude 5,000 and below or use supplemental oxygen in a little airplane. All right, there's your chart, 91.211. You might be asked about that.

All right, let's go back. So we've got-- I guess, in this flight planning example, we've done 6,500 feet. So you can see we filled in the altitude. We're going to climb, go to 6,500 feet. Our true course is 287, and you can see these fixes. They'll be in Fitchburg, crossing the river, finding some reservoir, finally landing at Bennington. So we'll just see what the folks-- these slides were built before Tina and I took over the course.

All right. As I said, pick those winds aloft. It says reporting points. Actually, that should be changed. That's inaccurate. They're not winds aloft reporting points. These are always forecast. There's no balloons up there with sensors to tell you exactly what the winds are. OK. Maybe somebody can remind me after the class to change that.

OK, so we fill in the forecast wind, and then we use our-- actually, no. We're going to need to find the airspeed, so we look up the performance tables for our Piper Warrior or we pay up for that Gyronimo app that you saw-- I don't know if they have a Warrior version, but maybe they do-- and we pull the numbers out of there. I'll just let you digest this for a moment.

All right. The important takeaways from here are we're going to burn about 2 and 1/2 gallons in the climb, 2 gallons in the cruise, and you can see how many minutes it's going to take to climb and descend. So that'll just go into our calculation of the total time. All right, so we've got that in there. See we've got our true air speeds for climbing and descending.

What about cruising? So we use the performance charts to figure out that we're going to be going along here at about 112 knots before the wind hits us. We add that to our plan. We've got all these distances. We've measured that with our protractor and ruler with our plotter. So we've got the distances for each leg. We filled in the true air speeds. OK. Now we do the wind



correction.

So remember, if we're reading, everything is in true. If we're hearing it on the ATIS, ASOS, or from the control tower, you can just say, wind check, please. You don't have to say your tail number or anything, and the tower is going to broadcast back to you, winds 310 at 12.

OK. So here's an example. I can do it in real time also on the doc camera, but let me show you this. So if the wind's from 210 at 20 knots and you're trying to go south at a true air speed at 147-- that's a good Cirrus speed-- you line up 210 to the true index. And then we're going to draw a little 20 knot vector here. It really doesn't matter where we start. We're going to draw a 20 knot vector here. So there's a little point for 20 knots up. That represents our wind.

Some people actually draw it as a vector. Imagine a little vector here. Or actually, it'd be going this way. Then we rotate so that we show our true course. So we're trying to go south, and the wind is from this direction, and we've lined it up. See how there is 140, 150? So that's roughly at 147. So it tells us, with this little subtraction here, we're going to be going just slightly slower than 130 knots or 129 as it says on the slide, and we're going to need to steer about 4 degrees off the true course. Does that all makes sense?

It's a little graphical calculator, basically, and the idea is you're starting with a vector that represents the wind. You can play around with this at the break. And I'll also try using it on the doc camera and you'll see just how much a person can forget in 17 years or 18 years.

OK. Now we've filled this in. We've said, OK, there's our true air speed. Here's our wind correction angle. Where is our ground speed? Oh, there's our ground speed. OK. So from the ground speed and the leg distance, of course, we'll be able to determine the time. Now this is the exciting part. Since we're only going 90 knots, we can figure out, for any given leg length, how long it's going to take. So we do that. Eventually we'll fill it in.

Oh, yeah. We've got to get the magnetic variation. So our true heading is supposed to be 293 or 283, I guess, in the cruise, and we add in the west variation. Remember east is least, west is best. So we've added in that magnetic variation and that's the magnetic heading. If we happen to have-- oh, yeah. There's a point to this slide. So what if we take all that metal fishing gear and throw it into the float plane? That might actually affect the compass, especially if you're up in Alaska.

Until about 2001 or 2002, it was required to carry a gun in your airplane at all times when you

were flying in Alaska unless you were in the traffic pattern at an airport doing flight training or something. So if you had your huge rifle up in the front of your aircraft, then your compass actually could be thrown off by the gun that you were required to carry. Who knows why you had to carry a gun? Why do you have to carry a gun in your Cessna?

**AUDIENCE:** Bears.

**PHILIP**  
**GREENSPUN:** Bears, that's right. Anyway, they changed the law, so now you can be a pacifist. You had to have ammo too actually. I think they could bust you if you didn't have ammo for your gun. All right. Actually, I was going to Alaska and the regulation was just being sunset, so I thought, well maybe I should bring a gun with me.

So I asked a friend who's a gun enthusiast, what would be the right gun? And he said, oh, you need this Benelli shotgun, automatically reloads the shells, and you can fire off a whole bunch of shotgun shells at once. It's like, you know, where can I get one? And he said, oh, I've got five, so you can just borrow one of mine.

OK. So yeah, here's another East Coast Aero Club plane. You've got to calculate your time. It might be pretty fast. That's from Oshkosh. They brought the B-1. Actually, this B-1 wasn't-- they ran away from that huge thunderstorm that I showed you. So I went through the thunderstorm in a \$99 tent, and the B-1 left. And the B-1 taking off was louder than anything that happened during the thunderstorm. It was crazy loud.

All right, so we've got it all filled out. It looks like it's going to take us a total of one hour. Does that make sense? Yeah. I guess about 90 knots about 90 miles, so yeah, that makes sense. OK. We calculate the fuel burn. So it's going to take us a minimum of 11 gallons or so to get there, and we want to have a half-hour reserve. I can tell you that's pretty scary to see the gauges down that low.

So I think a plan for a one-hour reserve is about as low as you would ever want to plan. And then beyond that, we should add some fuel to get to our alternate if necessary. In the instrument flying world, you plan to fly to your destination, fly to your alternate. Actually, fly to your destination, fly in instrument approach, kind of fly the mist, fly to the alternate, and then fly around for another 45 minutes to an hour after that.

All right. What about the VFR fuel requirements? So again, the FAA minimums are pretty scanty, 30 minutes for the day time, 45 at night. For helicopters, they're even less, 20 minutes

and 30 minutes, 20 minutes day and 30 minutes at night.

OK, weight and balance-- that's off the tail of a Piper Cub at Oshkosh. Unfortunately, we don't have that on the Warriors, which nobody loves quite as much. So the glorious plan here-- some of these older airplanes actually have better payloads when they're fully fueled than the latest and greatest because they're not crammed with as much helpful avionics.

Anyway, so the original Warrior, this plan is to take two heavy people in the front, 400 pounds total, two more virtuous people in the back, and 50 pounds of bags. And you see the max gross weight is 2,325 on this Piper. So can we do it? You're going to have a long, not to say tedious, lecture on weight and balance later, so we won't belabor this. But if you look at that loading, the perspective loading, I think we should expect that it's going to be within the center of gravity limits because the heavier people are in front.

And the real issue is whether we're overweight or not. So we are actually overweight. See that 2,334, and 2,325 is the maximum, so we're about 10 pounds overweight. How about, are we out of CG? We're at about 92 inches. And you can see here that the CG envelope goes to about 93. I guess it goes exactly to 93. So the CG is fine, but the weight is too high. What's the question?

**AUDIENCE:** Where would you find all of the information about the load requirements?

**PHILIP**  
**GREENSPUN:** Oh, yeah, so that's a good question. Where do you find all the information about the weight and balance that you're going to use for this calculation. So remember we talked about AROW. You have to have the airworthiness certificate, the registration. The owner's manual, I think, is the best way to think of the O, and W is the weight and balance.

So it has to be in the aircraft. It's usually just in the same binder as the pilot's operating handbook or the AFM. So it's there. It's specific to the airplane. And the airplane will get re-weighed periodically, and if any kind of equipment is changed out, they throw it in there.

But also, these apps-- I mean, the arm of the rear seats in a Piper Warrior, that doesn't change from aircraft to aircraft, so you just punch that in. You just punch in, I think, the total moment and the total weight of the empty airplane into an app like Gyronimo, and then it'll calculate the rest of it for you.

But it already has the arms for each position in the aircraft. Remember that's just a distance from-- they'll pick some arbitrary point on the aircraft like just in front of the propeller, and

you're looking at the number of inches back from the propeller, for example. That make sense? OK, so we're overweight. Will it fly 10 pounds overweight? What do you guys think?

**AUDIENCE:** It will.

**PHILIP GREENSPUN:** It will. And it will actually fly up to about 30% overweight generally, because I think people get waivers to take off with an extra fuel tank when they're trying to cross the Atlantic or the Pacific Ocean or something. However, it's an especially bad idea to go overweight if it's turbulent because the aircraft is designed for handling turbulence up to its gross weight.

So that's one thing that happens when people fly over gross, is that it tends to strain things that shouldn't be strained. So it's a bad practice as a regular matter. And of course, you're also reducing your performance margins. But you know, on a winter day in New England, you have ample power, so it's not like the airplane won't fly. But it's not legal to fly, and I try never to exceed the gross weight. What was the question?

**AUDIENCE:** I thought maneuvering speed goes up with weight.

**PHILIP GREENSPUN:** It does go up with weight. That's a good question. If maneuvering speed goes up with weight, why do you start bending things? I think that it's not just G-loads that'll bend the aircraft. It's also the overall weight of the stuff in there. I don't know. That's a good question for a real Course 16 or Course 2 engineer. What do you guys think? That's what I've heard though. If you load it up, it will--

**AUDIENCE:** There's a max [INAUDIBLE] weight, right, which has nothing to do with air holds?

**PHILIP GREENSPUN:** That's true. But I have heard that, if you're in smooth air, you'll probably get away with it for quite a long time. But also, you want that performance margin. If you get into a downdraft off the lee side of a mountain, you want some kind of reasonable climb rate. And if it's one pound over gross, you're going to be good. But the higher you go over gross weight, the less performance margin you have.

That's why training is so great in a four-seater helicopter or airplane because you have a lot of power to get yourself quickly out of an uncomfortable situation, whatever it is, because of those two empty seats in the back.

All right. Takeoff performance-- we figured out that we only need 1,000 feet of ground roll. And there are really no obstacles at Hanscom Field, so the 2,000 foot number isn't even relevant.

We have 7,000 feet of runway so we're good there. Landing, we're going to clear a 50-foot obstacle, which we can expect to find probably in Vermont.

They have plenty of trees and hills, so let's make sure we have at least 1,500 feet of runway plus some margin, which we do. So the book says we can land in 40% of the runway. And remember I told you that, for airline operations, you try to make sure you can land in at least 60% of the runway, so we're good there.

Here's the sample flight plan form. At the bottom, I say a fun exercise is to look at the ICAO, the international flight plan form. I should have probably put in another slide. It's so complicated that there's nobody on the planet, I think, that can really fill it out, but computers will do it for you.

Anyway, here, this has been in use probably since the '50s. You're just telling the FAA what kind of aircraft you have. A few things-- when they ask you what type it is, that would be something like SR20 for a Cirrus or PA-28 for a Piper Warrior. True air speed is going to be as computed, not indicated but corrected for your pressure and density altitude.

Also, on the aircraft type, there's a slash for special equipment. So if you have a GPS on board, which is no longer special, you're supposed to put slash Golf, so SR 20 slash Golf, so the controllers, if they are actually talking to you, they know that they can tell you to go direct to some fix that's only in the GPS. Anybody find the ICAO form? Who wants to fill it out? All right, good.

Actually, let's do it the real way. Let's go over here to the doc camera for a moment. So you've got your handy dandy pencil, and let's say the wind is from the north. So we just pick any old spot here. And let's say it's a 30 knot wind. So the wind's blowing from the north at 30 knots. That make sense? OK. And we want to go south with a wind true north.

So now we say, well, what's the air speed of our Cirrus? It's about 150 knots. And then we can read at the bottom of our vector, and now that wind vector has blown us to 180 knots. Is everybody happy with that? All right. so We put the dot on the-- and it's explained up here at the top. Zoom in slightly.

OK, let's try some other situations. What if we want to go west? That wind from the north, again, we put it here on the 180. Oh, sorry, put it on the 150. So we're cruising at 150. So remember I said-- this is actually reflected here-- that a beam wind is a slight reduction in

ground speed because you're also trying to fly into the wind.

So you can see here, our ground speed has been reduced from 150 to about 148 or 147, and we need a wind correction. You can see here this is the 10 degree line, so we're going to need a wind correction of about 12 degrees. So I'll have to steer right about 12 degrees. And let's say the wind was from the south. Oh, no, the wind was from the north.

So if we're trying to go north, then it becomes really simple. We put it on 150, and now we're only going 120 knots. All right, I think I survived that. That was one of my big fears about this class. So I learned to do that in-- oh. I learned to do that in 2001. In the fall of, I guess, probably early 2002. Scary, huh, how much people forget?

All right. I just want to show you one of these sites. OK, so here we are in SkyVector. We can store some flight plans because I am logged in. So I'll open an existing plan, and I'll say I want to go from Bedford to Bennington today at 20 Zulu, which is 3 o'clock local time. So as soon as the class is over, we teleport to Hanscom Field. The instructor has already preflighted the warrior, so we jump in and we go.

All right. So here we have-- I think you saw this before. Here are the points that I picked out as being maybe easy to recognize from the air along our trip. And we say, OK, well what's the weather going to be like? So we just click here, and we get an official briefing from a flight service station. Voila.

Oh, special at Bedford. Winds 180 at 17, gusting 26, 4 statute miles of visibility, light rain, mist, overcast 800, temperature's 13, dew point's 12, so that's not much of a temperature dew point split, and sure enough, the clouds are pretty close to the ground. Right? With a 1-degree split, you'd expect the clouds to be close. Peak wind was 180 at 27.

Look at this terminal forecast. The longer the terminal forecast, usually the more upsetting the weather is. It's going to be down to 1 statute mile, heavy rain plus RA, overcast 800, and it's going to be gusting 38. That's at 1800 Zulu. I think we're departing at 20 Zulu, we said, so that's the forecast for our departure time. That's not looking so good.

The good news is there is no really upsetting NOTAMs. I think this is this new-- you can look it up in the AIM 5/5/5 for the runway condition code, 100% wet, but I think that means the braking action is still just fine, as you'd expect for a groove runway. All right, so everything's good there. How about Bennington?

**AUDIENCE:** [INAUDIBLE]

**PHILIP** There's what?

**GREENSPUN:**

**AUDIENCE:** There's what look like [INAUDIBLE]

**PHILIP** Oh.

**GREENSPUN:**

**AUDIENCE:** [INAUDIBLE]

**PHILIP** OK, the student asked about the colored pins, by which I think he means the pins of color. So

**GREENSPUN:** the red is IFR weather conditions, and the blue, I think is, marginal VFR. And you can set that up in these layers. So yeah, see text weather, it's converting those text weathers to graphics.

OK. Good question. Yeah.

So anyway, it's kind of an ugly day. Maybe we want to fly some other time. However, we could file the flight plan if we wanted to. And it also will give us this helpful little nav log here that we can use in the aircraft. So all that hard work that we were doing with the E6B can be done for us free and very easily and very conveniently with just a couple clicks on SkyVector. I see that Tina's here, so she's a huge ForeFlight plan. Where? Oh, yeah. There she is. So Tina will tell you, maybe it would've been even easier on ForeFlight.

But SkyVector does many fewer things than ForeFlight, and therefore, the interface is simpler. And of course, the ForeFlight folks will be here at 3:00 and I'm sure they'll tell you why ForeFlight's better than SkyVector. All right. Let's go back to the presentation here. These are just some of my favorites. Like I said, there's a whole ton of these apps. Question?

**AUDIENCE:** How do you file a flight plan? Are you just printing it out, or do you send it to someone?

**PHILIP** Oh, yeah. The question is, what does it mean to file a flight plan? So the FAA has these

**GREENSPUN:** computer systems, these old mainframes, I think. For a while, they had Philips mainframe computers. You may not have heard of Philips as a popular vendor of computer systems. That's because they exited the business, I think, in the late '60s or early '70s.

But the FAA had all this software that was running in Philips machine code. So they were emulating the Philips mainframes on more modern systems right up into the 2000s at least.

I'm not sure if it's still that old Philips code that takes your flight plan, but something similar.

So your flight plan gets sent from whatever application you're using, I think, to maybe Lighthouse, the Lockheed Martin spinoff contractor that took over flight service in 2005, I believe it was. And from there, it goes into some FAA computer system and it's accessible to the controllers.

If it's an instrument flight plan, they'll develop a route for you. If it's just a VFR flight plan, point to point, and you're going to activate it and deactivate it manually, it may stay with the flight service station because the controllers have no reason to know about that or care. Does that answer your question?

Yeah, so there's a whole bunch of different places that can enter the flight plan. Where it gets more complicated and where I think an application like ForeFlight might come in very handy is international flying. So if you go to Mexico or something, you end up physically walking over to the control tower and there's people who help you there. They fill out the forms on paper and it's kind of fun. You've got to budget an extra half hour before every departure to fill out all the paperwork, but they're all nice people.

**AUDIENCE:** So if you had to call in your flight plan, which happens more than you would expect because you could be out in the wilderness with no internet, what information do you provide then?

**PHILIP GREENSPUN:** Yeah. The question is, what if you have to call in on the radio your flight plan to the flight service station? What do you provide? Basically, they'll prompt you if need be, but some people, on their kneeboard or whatever, will have the elements of a flight plan.

And you just read out the same as the flight plan form, where you want to go, what your registration number is, 707 Whiskey Tango, your type, SR20 slash Golf, how many souls onboard, how much fuel you have, all that other stuff. And they enter it in the system just as if you've done it on the phone. You can also do it by calling that 1-800-WX-BRIEF number. You can do everything by phone. Question? No.

All right, let's see what else we've got in here. Suggested reading-- so FAR 61 and 91 is the stuff that you're going to be tested on, but it might not be the best plan for prudence. So for example, in Canada, you need special training and an endorsement at least. I think it might be a rating. You need special training and, I think, a rating to fly at night VFR. In some countries, VFR flight at night is just simply unauthorized. As Tina mentioned, you have to file IFR, I think,



if you want to go flying around at night in Mexico.

For FAR 135, they say, look, you can't fly single pilot IFR with no autopilot. You have to have some way of taking your hands off and not having the airplane go upside down in the clouds. Yeah, so just look at those operating limitations. And when you're doing your flight plan, just ask yourself, should I be doing something that is more aggressive than what the charter and the airline crews are permitted to do?

All right, so we can take questions. And meanwhile, I'll show you-- while you're thinking of your questions, here is the planning. Well, it doesn't really show the planning, I guess some of the planning. We had to load up this Pilatus with 60 sea turtles. I think that was late November or early December. So you can see, there they are in the back of the airplane. They're in these Chiquita banana boxes. Here is a Garmin 650 in the front of the airplane showing that we're just entering Virginia, I believe, and we still have two hours to go before we get to Panama City, Florida.

We're getting 281 knots over the ground, which is a little bit of a tailwind. That's unusual going to Florida. When we get there, we get treated like rock stars. There's a TV station there. The turtles are here being transferred, and there's our cockpit at night. We flew back at night. It was kind of a long day, maybe 7:00 AM to 9:00 PM or something. And there's one of our sea turtle friends.