TINA SRIVASTAVA: I think it's a really basic point of curiosity in the world, and people that come to MIT, who are very passionate and want to change the world, should know how airplanes fly, some information about aviation, and the incredible feat of humankind to be able to fly through the air.

SARAH HANSEN: Today on the podcast, we're talking flight, specifically how a course has been designed and refined to allow hundreds of students to pursue a path toward flying.

TINA SRIVASTAVA: I thought that it was really important that any student that's interested in this have the opportunity to learn about airplanes and learn how to become a pilot themselves.

SARAH HANSEN: Welcome to "Chalk Radio," a podcast about inspired teaching at MIT. I'm your host, Sarah Hansen, from MIT OpenCourseWare. In this episode, we'll be talking about MIT's flight school with two of its instructors, Philip Greenspun and Tina Srivastava.

In our conversation, they share how a number of innovations have made the course incredibly popular, both in and outside of the MIT community. Part of why we want to highlight this class is that its evolution has allowed for a nimbleness of structure without sacrificing the effectiveness of its instruction. It's truly fascinating that something as seemingly technical as flight school can take so many different shapes.

I wanted to dig into how it's possible to find flexibility in instruction with such high risks and, also, what made this course so successful at attracting and preparing future pilots. We'll pick up our conversation with Philip and Tina explaining what it means to have access to flight school and what it really takes to take flight.

PHILIP GREENSPUN: People have been wanting to fly for thousands of years, and only in the last 100 years has it become a practical reality. And the US is unique, in that it's half or a third of the price here and much easier to do in the US than any other country. So as long as people are here in the US for whatever reason, they're never going to be probably more than half an hour's drive, or an hour's drive, from a flight school. They're going to have the ability just as an ordinary consumer with a credit card to spend 5 or 10 hours mastering the basics of flying.

So one thing that I've tried to stress in the class is that they don't have to commit to getting an FAA Pilot Certificate, which means that you're safe to be the only pilot in the aircraft. You can go down to the flight school. You can get your hands on the controls, and within 5 or 10 hours, learn to take off, fly around, land without the instructor having to touch anything or say anything, and that's doable for both airplanes and helicopters. Just motivating people to try to get up in the air and enjoy this unusual freedom that we have here in the US.

I jumped in as part of the staff a year ago, and I have spent about a month going through the PowerPoints to emphasize that this is an activity that can be done safely, especially with a two-pilot crew. Maybe it's the instructor and the student, or maybe it's a certificated pilot and another friend who happens also to be a pilot. So I did that, and some of it was just wording.

People naturally who are pilots, unfortunately, they'll tend to stress the hazards and how they avoided them. I think part of it is it makes them seem more impressive. So there were a lot of PowerPoints that says, well, they had the form of, you will die, if you will do X. So I just edited them to say, you'll be safe, if you do not X.

SARAH HANSEN: Right.

PHILIP GREENSPUN: But it was still hard. We had a guest lecturer who's an aerobatics instructor.

SARAH HANSEN: OK.

PHILIP GREENSPUN: He spent some time talking about the hazards of midair collisions and how people avoid them, but if you look at the data, that's only 2% of accidents. It's not a common way to have an accident at all.

SARAH HANSEN: OK.

PHILIP GREENSPUN: Why scare people about it? Obviously, it's good to avoid any accident.

SARAH HANSEN: Right.

PHILIP GREENSPUN: But he didn't share with the students, look, I'm telling you about something that accounts for only 2% of accidents.

SARAH HANSEN: Right.

PHILIP GREENSPUN: They're sitting there terrified that they'll be flying along, and all of a sudden, somebody will smash into them.

SARAH HANSEN: Interesting. The course format has evolved from a weekly two-hour course taking place over an entire semester and turned into an intensive three-day program. This change has created more interest in the program and allowed more and more students to not only pass the FAA exam, which is the course's intended goal, but to go on and actually earn their Private Pilot Certificate.

TINA SRIVASTAVA: So I got engaged in the course 16.687, the Private Pilot Ground School, in 2015. At the time, I was completing my doctorate at MIT, and as we continued teach the course, over time, we discussed the potential of changing the structure of the course, and last year was the first time we changed the structure of the course. So instead of being two-hour lectures in the evenings over the full spring semester, it became the three-day intensive course. In the new learning format, I think the advantages are that the students can focus exclusively on this course for three days.

SARAH HANSEN: Sure.

TINA SRIVASTAVA: So they're not distracted with other courses or other activities. They're just focused and living and breathing everything about becoming a pilot that's necessary, and I think that level of engagement has a different set of advantages. And so last year was the pilot of the new format, and it was very successful in many ways. We had about 101 students on the first day, and we completed the course with about 98 students. That was a big accomplishment, and we engaged a lot of the students again, in terms of not only completing and passing the FAA exam but continuing that enthusiasm and getting their Private Pilot Certificate.

SARAH HANSEN: In my conversation with Philip and Tina, it became clear that there was something important about having this class meet in person. It seems like exactly the kind of content that might easily be converted to an online format, but there was something that made an in-person gathering not just useful but essential here. So I asked them, why not just do this online?

PHILIP GREENSPUN: So MIT students are really good at reading books, and this material, to pass the test, you can self-study successfully. People do that at commercial flight schools. They just go home, and they read all the FAA books which are available online in PDF. So yes, you have to ask yourself, what's the purpose of even having lecture halls and a university, when there is so much available online, and when you have a population of people who are great readers? And reading is three times faster than listening, in terms of just being able to get through information.

So that was part of why we said, well, look, we can do this in three days, because we're not going to try to cover everything and spoon feed it to people. They can read the book. So we'll ask them to do a little bit of pre-reading, and they we'll inspire them, we hope, with the in-person experience, and then they can go back to the books. Whereas, I think the traditional class assumes that people don't have access to a lot of information outside of the course.

SARAH HANSEN: I see.

PHILIP GREENSPUN: Or that they have to be just guided, where they'll spoon-feed you with a problem set or a reading assignment.

TINA SRIVASTAVA: Yes, absolutely. I would even say that less than half of the course was about the FAA knowledge of them, and the reason I would say that is that I think that so much more of the course was about becoming a pilot. A lot of the discussion and the interaction and the interactive discussions were really focused on decision-making which is very critical for a pilot.

Just because you can answer a factual question about the weather, for example, doesn't necessarily mean you've fully evaluated whether it is safe to fly, whether there are alternate options available, how you go through that whole decision-making process. We discuss everything from aircraft ownership, shared rentals, flying with friends, going on vacations, to really try to share with students how they could be empowered as a pilot, and we provided a lot of tips and insight from our own flying experience.

For example, in the case of night flying, the idea of trying to take off before the sun has set, so that you begin to acclimate to the night environment over time. These types of insights and experiences are not part of the FAA knowledge exam but were some of the most important pieces of the course based on the student feedback we received. So it's really about what the students are interested in and engaged in.

Throughout the three-day class, we also have a number of breaks, and at every single break, we would have students come up and either share an experience or ask a question or for clarification. And that type of feedback also helps us inform how we taught the class and how we connected different elements of the course together to help answer or provide some enlightenment on a particular topic and how it relates to other topics.

SARAH HANSEN: One of the things I was most curious about was how Tina and Philip were able to bring over 100 students working at different paces through this material. These classes are often so full that there's a whole other overflow classroom to accommodate the numbers. What does it take to do that?

TINA SRIVASTAVA: One of the ways that we engage them is a traditional method of just asking a lot of questions, and we would call up students to answer them. So we had a very engaged group of folks. Sometimes, we'd asked questions, where we'd ask students to raise their hand to give us an answer, and sometimes, we'd ask students to shout out an answer.

SARAH HANSEN: OK.

TINA SRIVASTAVA: A couple of times, we used some FAA practice exam questions, and we would have students raise their hands, whether they thought it was A, B, or C. And depending on how divided students were on the answer, we knew whether we needed to spend more time on the topic or not. So for example, one of the questions that we asked them was a real question from the FAA exam and a question that I got on my own FAA exam which was about right of way, when you're flying.

SARAH HANSEN: OK.

TINA SRIVASTAVA: So it was, if you're flying, and there is an aircraft refueling another aircraft, a glider and a blimp, which has the right of way?

SARAH HANSEN: Oh.

TINA SRIVASTAVA: And this was a really good question, and it generated a lot of differences of opinion. We had basically a split of students guessing all of three options. So I'll leave that interesting question there without the answer, so you'll have to view the course to find out.

PHILIP GREENSPUN: Yeah. I guess what I would add is that it was good to have-- we had fairly frequent coffee breaks and a pizza break, but a lot of it was-- the slide presentation to the students-- was really there to set the stage. And just having Tina there with a PhD in aero-astro, that's way above and beyond what people would have available in a typical flight school to really look at the engineering trade-offs instead of just saying, this is how it works. Here's your Cessna.

It converged on this design sometime between the '30s and '40s. One good thing about aviation is there's a huge amount of government-produced stuff. The FAA has done a good to great job about making graphics available for every kind of aviation topic. So we mined a lot of this public domain material from the FAA.

SARAH HANSEN: While having these materials accessible in the public domain can be a real boon to anyone teaching complex materials, it's rarely enough just to point to the resources and expect the knowledge to sink in. I wanted to know how these elaborate and math-intensive concepts were conveyed to students in a way that empowered them not only to pass the FAA knowledge test but to be informed, practicing pilots. To conclude our conversation, I asked Tina and Philip how they go about creating clear and useful instruction on complex topics, and they told me about a critical lesson in the class, weight and balance.

TINA SRIVASTAVA: For weight and balance, what you're talking about is how you load the aircraft, in terms of the fuel, the passengers, the baggage, and how that affects the flight. And so we used a physical model airplane to really demonstrate the effect on an airplane, if your center of gravity was too far aft on the airplane. We also solicited input from the classroom regarding their weight and weights of bags.

We gave them some insights and tips that whenever they're flying to not necessarily trust what their passengers tell them is the weight, their own weight. So to be safety conscious, maybe apply a factor of safety on what your friend tells you that they weight, and we used a book to show how you can do calculations. And we also went live online to the website of certain flight schools to show how you can find the exact gross weight and loading characteristics of different aircraft and different online calculators that calculate weight and balance for you and project that.

And then finally, we also showed how to do those calculations on an iPad with foreign flights. So we showed, again, different ways to approach the same information and materials. So that it wasn't just an academic description of how to calculate weight and balance, but truly how they would do that as a pilot, not just the FAA regulations for it, but how they would go about doing that for a flight that they fly on.

[PLANE ENGINE]

[MUSIC PLAYING]

SARAH HANSEN: If you're interested in learning more about becoming a pilot or just about the flight school itself, you can find the flight school materials on our website at ocw.mit.edu. And if you're an educator, check out our special portal on the site just for you at ocw.mit.edu/educator. Thank you so much for listening, and if you like what you've heard so far, please consider subscribing and leaving us a review. Until next time, I'm Sarah Hansen from OCW.

[MUSIC PLAYING]