PROFESSOR: In order to anchor the class, and provide an application that is at the same time realistic, but not overly complex, we chose to participate in the 2016 CANSAT competition. And CANSAT is just what the name stands for. It's the design of a satellite, that fits into a can, that is launched, not into space, but at relatively high altitude with a sounding rocket, essentially.

And so the CANSAT competition has been run for about 20 years. It's quite well known, and there's teams from all across the world that participate. There is now a CANSAT competition in the US. There's also a European version of it.

The goal of the CANSAT competition, is for students to go step by step through the design process. The starting point for the students, is a set of requirements, 47 requirements that are given by the organizers, about what the particular system has to do. For example, the CANSAT has to fit within the payload fairing of the rocket. It has to survive the launch. So a certain number of g loads and vibrations have to be survivable by the payload. The payload then has to separate into both the glider portion, and the actual container that contains the payload. On its way down, the payload has to fly in a circular pattern, for about two minutes. And during the descent, it has to record temperature and pressure of the atmosphere. And you get extra bonus points if you record images, and transmit those images to the ground.

The students who are responsible for everything except the rocket itself. So the design of the glider, the container, the ground station, and all the procedures.

So what's interesting about systems engineering and design, is that there are different approaches, how to tackle the problem. One is an approach where you take it step by step, and you try to basically get the right answer at every step. But, at some point you need to check yourself, as well, with milestones. The other approach, and that's typically what we call a waterfall, or stage gate process, which is what's applied in very large systems, where it's too expensive to do a lot of prototypes, and you have to get it right the first time. The other approach is spiral development, or agile, or rapid development, where you do quick prototypes, and you learn very quickly, and iterate your design. And in some sense, what we're doing in this class, is a combination of the two.

What was very rewarding, is to see how students ideated their concepts, always keeping in mind the requirements, and the end goal in mind. But, also testing those ideas, either through modeling and simulation, or with very simple prototypes that can be made out of paper. One team actually produced a 3D printed version, of their glider, even though that wasn't officially necessary before the key milestone, which is the PDR. And so it was interesting to see, how every team approached it slightly differently.