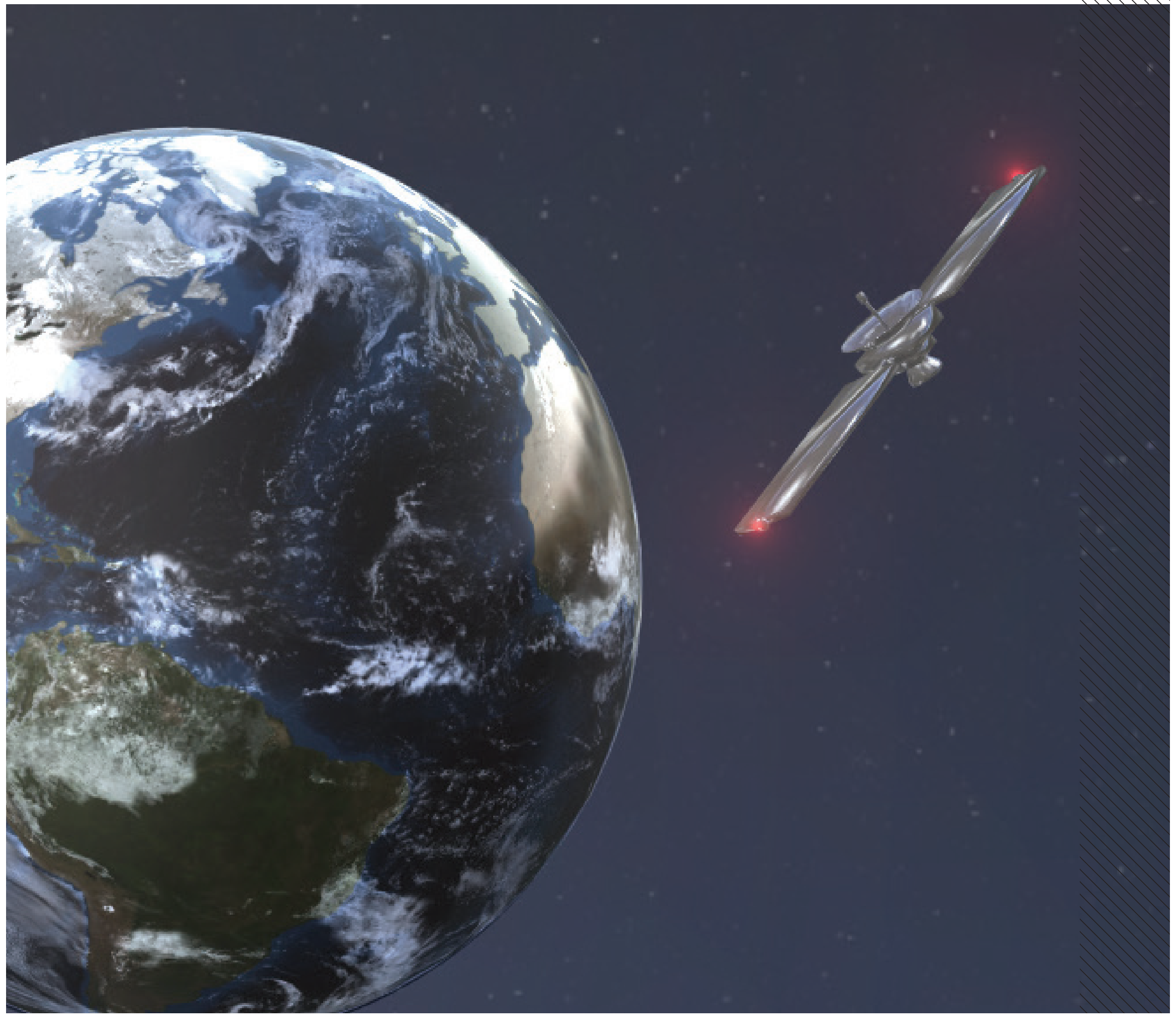
SKY'S NO LIMIT

ENGINEERING PHYSICS STUDENTS SEND THEIR WORK BEYOND THE ATMOSPHERE

TEXT Meredith Sell '14

In a year, a satellite built by Taylor engineering physics majors may enter a region of space where only spy satellites have been before. ELEO-Sat, a project of the current senior class, is being designed to enter Extremely Low Earth Orbits(ELEO), a "tenuous region between space (where satellites can stay up) and the upper atmosphere," Hank Voss, professor of engineering, explained. "That region is really exciting because it's where climate models and the sun-earth connection take place."



ELEO is also exciting because it's just above earth's atmosphere, which drags and wears on any objects within ELEO.

"Usually satellites decay because of the drag ... so they can't stay there very long," Voss said. "We're building small satellites that are aerodynamic and have a lot of mass in them, so they'll stay up longer."

Twenty students have had their hands in the ELEO-Sat project. One is working on an ion engine that will keep the satellite elevated using solar energy. Others are working on integrating components from two other satellites: Taylor Satellite (T-Sat), which is being launched by NASA in February, and Communication Satellite (ComSat), designed for communication between satellites, will take to the skies in June.

"Most satellites have a ground system," said Stephen Straights '14, who acts as mechanical engineer on ComSat, building the satellite's frame, integrating the various systems within the satellite, and making sure everything holds together. "We're not going to need a ground system, because ... our satellite [will be] communicating to other satellites as it's going around the world. Those satellites will send its information to us."

Components measuring temperature and electrical energy, among other things, will be part of ComSat. More will be integrated into ELEO-Sat, the biggest of all three Taylor satellites.

The satellite projects—T-Sat, ComSat, ELEO-Sat—are only a few of the ways engineering physics students have put their training to use while earning their degrees. Over the years, Taylor students have worked on a solar car, sensors for oil wells, a particle accelerator, the building design of the Euler Science Complex, weather balloons and satellite instruments for NASA.

"We were building satellite instruments for a while," Voss said, "and we realized with miniaturized electronics, we could actually build a whole satellite in very small form. Then we needed to test it, so we tested our first little satellite on a high-altitude balloon to get the transmitters checked out. We saw how good ballooning was . . . it sort of ramps itself up naturally."

Grants from NASA, the National Science Foundation, and the Air Force fund most of the projects. Over the past two years, the physics and engineering department received $110,000 from the Air Force. The funding was used to buy equipment for building the satellites, pay students to work on the project over two summers, and cover travel costs for students going to conferences to present about the satellites.

Straights was one of 10 students on the project last summer. Kate Yoshino '15 joined the crew halfway through the season after finishing a Research Experience for Undergraduates (REU) at the University of Cincinnati.

Both Yoshino and Straights started their engineering physics training with classroom work, learning the physics, math, and theoretical laws behind the universe's operations. With projects like ELEO-Sat, they've put this knowledge to work.

"If you want to learn how to swim, you can see all the blackboard, whiteboard diagrams of how to swim," Voss said, "but at some point you've got to jump in and learn."

They started with balloon launches—sending helium balloons into the upper atmosphere with sensors and trackers attached.

"Balloons teach you about integration, working in teams, solving problems, debugging, [and] learning how to build better overall design," Voss said.

Now they're applying those lessons, along with their knowledge of math and physics, to practical problems introduced by the satellite project.

"[The satellite project] is closer to what we actually will do in the real world," Straights said. "Rather than just learning how to do an equation, we get to apply what we're learning."

"When you work on a project, you obtain knowledge you wouldn't get in a classroom," Yoshino said.

Straights and Yoshino faced a steep learning curve on entering the ELEO-Sat project, but neither felt unprepared.

"Dr. Voss has a mentality of whether you know how to swim or not, he's throwing you in the water," Straights said. "The underclassmen course work prepares you for the real demands."

"Hank Voss will often say, 'We produce thinking engineers,'" said Ken Kiers, physicist and chair of the physics and engineering department. "We're trying to teach them to become not just use-the-equation, don't-really-understand-it [people], but people who analyze things and understand them in a real way, which makes them better engineers."

Their training starts on the ground, but with time, students take to the skies—or their work does. And they carry the lessons they learn along the way into their futures.

"Things don't always work the way you want them to," Straights said, "and things you think may be easy tend to not be as easy as you think."

Engineering is a process of asking and answering questions using the tools of physics.

"We want to do this in space. How do we get there?" Yoshino said.

"Our students are expected to work and design and develop things at a high level," Voss said. "They can impact the world."

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