Students break new ground in Hyperloop challenge

September 29 2021, by Daniel Strain

The team inspects a hole dug by engineers from The Boring Company. Credit: CU Hyperloop

Imagine living in a city in the distant (or maybe not-so-distant) future: You need to make an appointment across town, so you step into a pod in an underground tunnel. From there, you're whizzed at breakneck speeds through a series of twisting and turning tubes that stretch below the city.

That's the vision behind the Hyperloop, a proposed mode of transportation seemingly pulled straight from science fiction.

"The more I learn about Hyperloop, the more I'm convinced that this is something that could revolutionize how transportation works," said Toby Savage, a senior studying computer science at CU Boulder.

But before that can happen, scientists will need to bring new advancements to an activity that humans have done for eons: digging a hole.

That's where Savage and the roughly 20 other students in a campus club called CU Hyperloop come in. The students recently took part in the final event of the first-ever Not-a-Boring Competition. This one-of-a-kind challenge pits teams from across the world against each other to build sturdy machines that burrow underground and excavate networks of tunnels.

The Boring Company, founded in 2016 by billionaire and Hyperloop proponent Elon Musk, sponsors the competition.

From Sept. 6 to 12, the students traveled to the desert outside of Las Vegas to put their engineering skills to the test. The team battled the heat and blowing sand to showcase their designs for the ultimate tunnel-boring machine. Once completed, their creation will look like a mix of a mole and a robot, using a cutting wheel the size of an extra-large pizza to burrow a perfectly round tunnel underground.

"It's been really stressful, but a lot of fun," Savage said. "Getting to meet all the teams has been a really great experience."

It's also been a chance for the students to see how engineering works in the real world.

"No one had experience on such a big project coming into the competition," said team member Cody Wheeler, a senior studying aerospace engineering. "We're a team of students who are all about teaching each other how to become better engineers."

CU Hyperloop gets ready to test out its tunnel support structure. Credit: CU Hyperloop

Feeling the heat

On Friday, Sept. 10, they were minutes away from one of the biggest tests of their skills yet.

One of just 12 finalists out of a global pool of hundreds of competitors, the student team traveled to Nevada to face searing competition—literally.

Temperatures frequently tipped over 100 degrees Fahrenheit during the event.

"I'm trying to make sure all the students are keeping hydrated and taking breaks when they need it," Wheeler said, via Zoom, from the test site.

Because of budget constraints, the students haven't yet gotten their machine to the point where it can dig. (That's their plan for the coming year when the competition will start up again.) But they have laid out how the robot will work and manufactured many of its components—which judges from The Boring Company scrutinized all week.

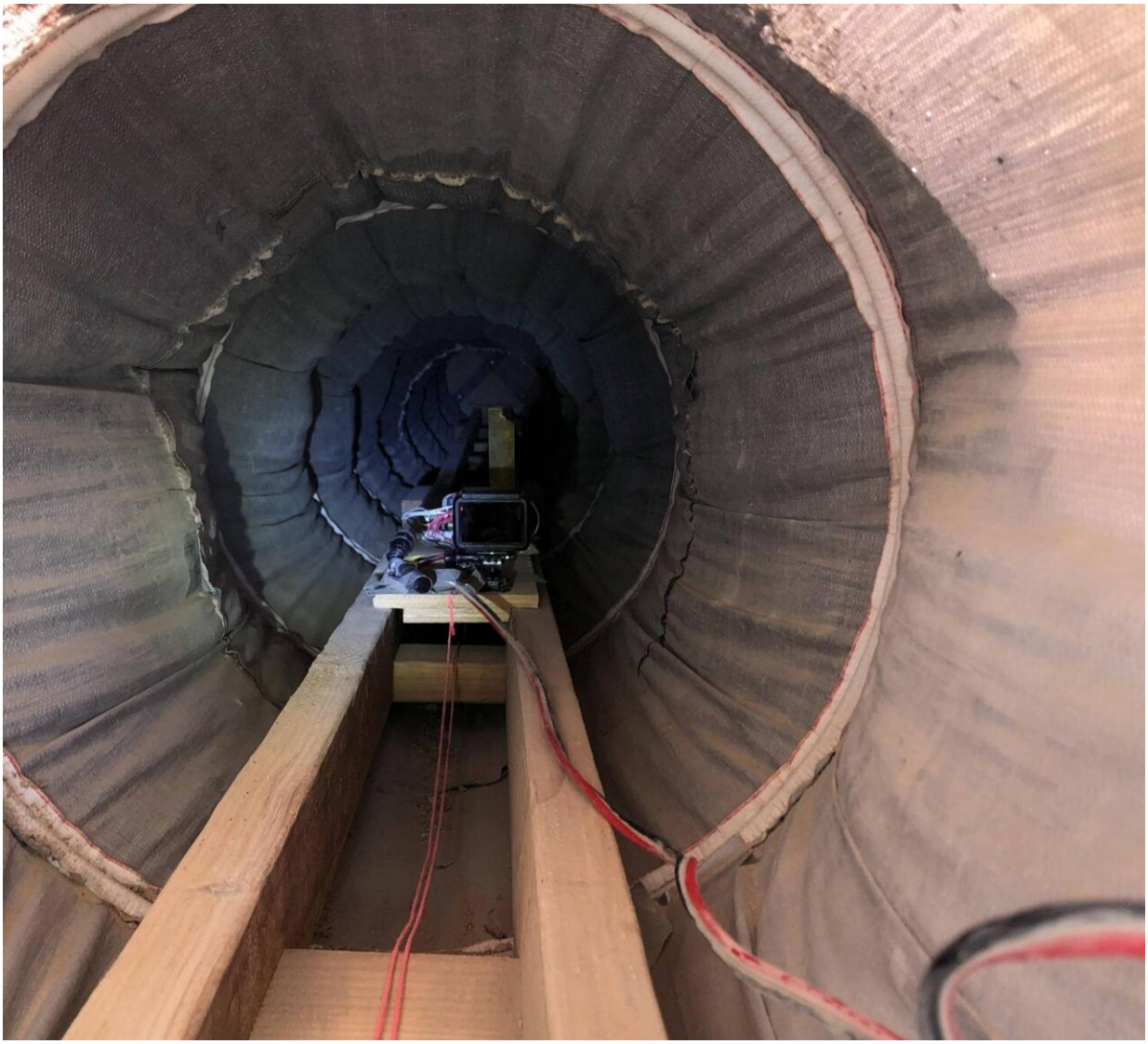
If all goes according to plan, the end product will measure about 14 feet from end to end and weigh more than 1,300 pounds, pushing forward by jabbing a series of teeth into the side of a growing tunnel. It will be able to, as the contest requires, out-dig a snail, moving underground at a speed of about five feet per hour. And despite the machine's size, it will be surprisingly nimble, able to pivot up and down and turn left and right.

The Boring Company is paying special attention to how the CU Hyperloop team plans to support these underground tunnels. Arjun

Mody, a sophomore studying mechanical engineering, explained that most of the teams in the competition will line their tunnels with rigid walls. CU Hyperloop, however, decided to go a more flexible route.

To shore up their tunnels, the team designed an expanding structure made from hardy metal rings connected by tarp.

"It's basically a super-strong dog tunnel," Mody said.



The tunnel support structure seen from inside. Credit: CU Hyperloop

As the boring machine digs, the structure will unfurl, filling the hole and preventing it from collapsing.

Or that's the hope.

On Sept. 10, the team put that design through its paces. Engineers from The Boring Company had dug a 20-foot-long hole at the testing site where Mody and his colleagues buried their tunnel liner under nearly 5 feet of dirt. They then dragged a series of sensors through the structure to make sure it could stand up to the crushing weight.

"I'm just praying it will hold up, and we'll get good data and won't have to change our plans for next year," Mody said from the site.

Ready to go

Back in Boulder days later, junior Zoe Zier said that the test captured the team's do-it-yourself approach to the competition. The CU Hyperloop team had just $50,000, raised from the Engineering Excellence Fund on campus and from industry sponsors, to design, fabricate and test their machine this year—a fraction of the funding that private boring companies have to work with.

To get around those limitations, Zier and her fellow students have had to think on their feet: They use a lot of inexpensive, off-the-shelf parts, including car jacks bought off Amazon. They also do all their own welding work and more.

"I think the coolest thing about our team is how much in-house

manufacturing we were able to do," Zier said.

The approach seems to be paying off. The team's dog tunnel passed The Boring Company's test with flying colors.

Now, Zier and her colleagues are turning their attention back to the competition. They're talking to engineering companies to raise more funds for the effort and will continue to hone their boring machine in the coming months. Then they'll get to digging.

"I'm so proud of what we were able to accomplish this year, especially with such a low budget," Zier said. "Next year, we're going to do even more."

Provided by University of Colorado at Boulder