

# *Leveling up the Space Domain Awareness Telescope*

*By*

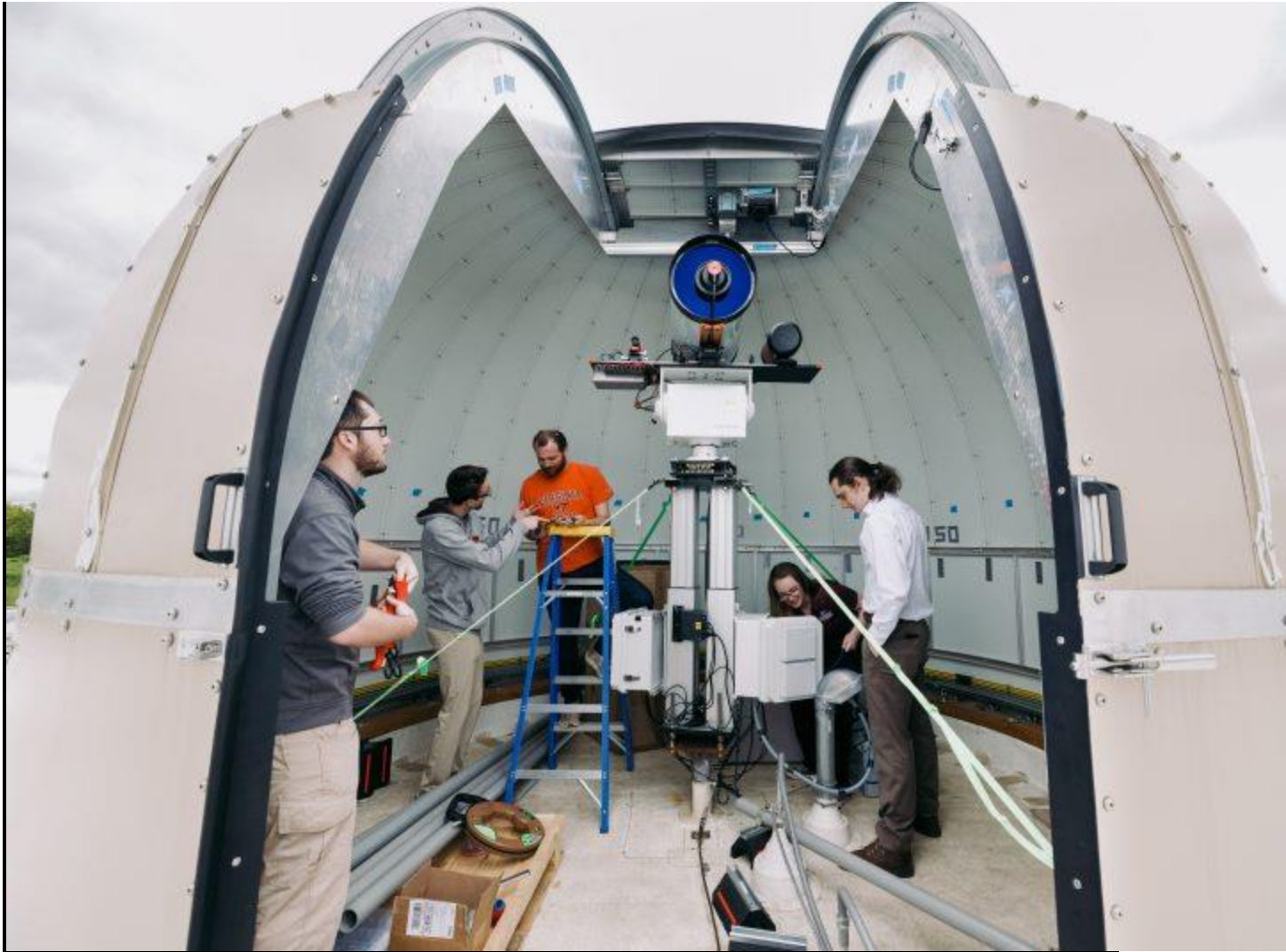
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The final step in moving the Virginia Tech National Security Institute's latest telescope project forward was moving the telescope up.

“Moving the telescope to the roof was the last big step in making it ready to work at its full capacity,” said Gavin Saul, a senior aerospace engineering major and a student researcher on the Space Domain Awareness Telescope project. “The telescope is huge so it required a lot of planning and a cherry picker to move it.”

With the move, the institute's [Mission Systems Division](#) (MSD) completed the first phase in a long-term series of improvements to the Space Domain Awareness Telescope.



Virginia Tech students Gavin Saul, Nick Angle, Rose Stanphill, Connor Thornhill, and Josh Smoot, performing a ribbon cutting after the successful first light test of the Virginia Tech National Security Institute's Space Domain Awareness telescope.

Along with relocating to a [telescope dome](#) on the roof of a building in the Virginia Tech Corporate Research Center, the

first phase included making improvements to the telescope's imaging and motion capabilities.

The milestone was celebrated with a first light test of the telescope conducted by the faculty, graduate and undergraduate research team leading the project.

“In any project like this, you'll have what's called a 'first light test' or a 'day in the life test,’” said Nick Angle, a graduate student pursuing a master's degree in aerospace engineering and a student researcher on the project. “These tests are the way of saying, ‘Here's our full system.’ All of that is our proper first light test to make sure all of our systems run smoothly together and actually take our first measurements.”

Leading up to the test, the Mission Systems Division team conducted years of planning and development activities and achieved a number of other fundamental milestones related to system reliability and safety.

One such occasion took place in November 2022 when the team captured imagery of a full lunar eclipse. This astronomical event was used to test the custom tracking software created by the team that is used in the mount of the telescope system.

After initial calibration, the custom software exceeded expectations. In addition to tracking the moon during the lunar eclipse, the team was able to successfully track multiple astronomical targets including Mars, the Orion Nebula, and Uranus.



Image of lunar eclipse captured by the Virginia Tech National Security Institute's Space Domain Awareness telescope.

While the eclipse event was used as a successful test, the Space Domain Awareness Telescope system will not be used primarily for astronomy and observation of solar system objects like a traditional observatory. Instead, the purpose of the telescope is to identify and track spacecraft.



A major goal of the project is advancing the Virginia Tech National Security Institute's workforce development initiatives by involving students at all academic levels to provide real-world, hands-on experience with cutting-edge optical systems for space operations. The hope is to encourage future careers in the space industry whether working for commercial companies, the federal government, or at academic institutions.

"This work is what I would call 'industry simulation,'" Angle said. "You're doing the work that isn't taught in classes. You can go out into the industry and you can say you have built a code base from scratch that lets me remotely control a telescope over the network. That's fantastic."

Angle is a long-standing member of the project, joining the team in 2018 when he was an undergraduate physics major at Virginia Tech.

"It was a fantastic opportunity to combine my love for astronomy and physics. The telescope is not only for tracking aircraft and satellites, but it also has instruments that can be great for deep space imaging, for astronomy, which is super exciting. It has driven a lot of my passion for the project," Angle said.

Similarly, Saul has been working with the team for almost two years and plans to continue working on the project over the next few years while he is pursuing his master's degree.

"I got started with the project because I went to an undergrad research opportunities presentation, and the team was

presenting the telescope project and I was instantly obsessed with it,” Saul said. “The telescope’s imaging capabilities are strong enough to capture astronauts on the International Space Station. I heard that and I was like, ‘I need to work on this.’”

The next phases for the telescope project include making the system fully robotic, allowing researchers to operate the system remotely, and eventually making the system fully autonomous so tests can be done without researchers continuously monitoring progress.

The university announced the formation of the Virginia Tech National Security Institute in 2021, aspiring to become the nation's preeminent academic organization at the nexus of interdisciplinary research, technology, policy, and talent development to advance national security. The institute houses the [Ted and Karyn Hume Center for National Security and Technology](#), which serves as the hub for national security-focused experiential student learning and workforce development at the university.



Virginia Tech students Gavin Saul, Rose Stanphill, Connor Thornhill, and Josh Smoot use the Virginia Tech National Security Institute's Space Domain Awareness Telescope.