

Thesis Project Portfolio

A Space-Based Solution to Improve Roadway Safety and Efficiency in Virginia: Real-Time Winter Weather Data for Navigation

(Technical Report)

Starlink: Societal Factors Affecting SpaceX's Satellite Internet Constellation

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

As a mechanical engineer enrolled in the Spacecraft Design capstone course at the University of Virginia, I was tasked with developing the design of a CubeSat as part of a collaboration with MITRE. To complement the technical discussion of CubeSat technology, the STS research paper focuses on Starlink in order to illustrate some of the societal factors influencing space-based satellite systems.

For the Fall semester, the Spacecraft Design course focused on investigating three potential use cases for remote sensing using CubeSats: detecting weather effects on roadways, nondestructive evaluation of roadway infrastructure, and optimizing rest stop truck parking. After consideration of the three options, remote sensing of roadway weather effects was chosen to be the focus for the design of the new CubeSat. In the Spring, the class tackled the conceptual design of a 6U CubeSat which could measure snow and ice on Virginia roadways while meeting all accepted CubeSat standards. In theory, the data collected could be fed to Google Maps to inform drivers of treacherous road conditions, and it could be used to optimize the use of Virginia Department of Transportation resources.

The STS research paper analyzes the emerging Starlink satellite internet constellation under the Social Construction of Technology framework. Originally, the plan was to examine the problem of space debris in order to show some of the considerations which must be made when developing a spacecraft. However, Starlink provided an excellent case study in this area, and ultimately the decision was made to pivot to a discussion entirely around Starlink. Within SCOT, an investigation into the relevant social groups surrounding Starlink shows how their interactions with each other are serving to influence the development of this technology.