

## **Thesis Project Portfolio**

### **High Resolution Satellite Imaging of Nitrogen Dioxide from Low Earth Orbit**

(Technical Report)

### **Positively Influencing Space Junk Policy by Utilizing Negative Emotions Toward Technology**

(STS Research Paper)

An Undergraduate Thesis

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

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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## **Sociotechnical Synthesis**

(Executive Summary)

Relating CubeSat Technology and Space Junk: Evaluating Stakeholder Relationships in Order to Increase Public Awareness of the Severity of Space Junk

My technical project worked on the development of a CubeSat satellite designed to measure levels of pollution over major cities. After considering the impacts that each individual satellite project has on the space environment, I decided to research space junk for my prospectus and STS research paper. The prospectus focused more heavily on the lack of governance between nations in creating policies for space junk. Somewhat differently, the research paper analyzed the roles that industry leaders and the public can have in reducing the amount of space junk that currently exists. The sociotechnical analysis that was completed for these two projects was specific to an Aerospace Engineering issue but its methods can applied to all engineering disciplines.

The prospectus portion of my thesis explained my technical topic and then went into detail about the increasing quantity of space junk and the small amount of international policy that exists for the issue. My technical project worked on the development of a NASA funded CubeSat satellite. These CubeSats serve as educational tools and cheap ways to obtain scientific information. Space exploration can be made very easy with the use of CubeSats, but there is an unintentional consequence when adding so many new projects into space. My prospectus explored the importance of recognizing how necessary a mission is before launching it into space in order to avoid adding more to the Earth's surrounding space junk.

The STS research paper further explored space junk by identifying the relationships between top industry leaders and the public in relation to space technology. I utilized Actor Network Theory and the Framework of Attitudes Toward Technology to build my argument for how space junk can be recognized as a public issue. I explained that top industry leaders avoid tackling the issue of space junk due to its

high cost and potential conflict with other nations. I argued that getting the attention of the public by exploiting images of space junk will result in an extreme public reaction that will cause policies to be made from the bottom up, similar to how most democratic systems function. As a member of the public being exposed to such images while working on the development of a satellite through my technical project, I can use the conclusion made from my STS research paper to be more cautious of the lasting impacts of my own satellite project.

When beginning research for these projects, I was trapped in my engineering mindset and was thinking very technically about space junk. Having to think analytically about the social impacts of this topic was very difficult and frustrating for me to accomplish at first. As a word of advice to future fourth years, I advise choosing a topic that is interesting and new to you. Space junk was not heavily covered in any of the technical courses that I've taken for my major, so this topic was fun for me to research and create a sociotechnical analysis for. Writing papers such as the prospectus and the STS research paper seems daunting for an engineer, but consistent drafting and rethinking of the approach to resolution is key. I was able to transition into thinking more socially about my research topic by first identifying the different stakeholders and using Actor Network Theory to define their relationships. Creating this web then made it easier to think about individual perspectives that may differ from my own. The transition into the research paper was made easier by having the technical backbone of my prospectus to work from. Comparing the two projects, I can attest that I learned much more from the STS research paper about the sociotechnical issues that are present in Aerospace Engineering. Being able to identify the actor network and stakeholder perspectives of a technical issue is an important skill that I can carry with me when working in industry.