

Thesis Project Portfolio

Student Researched and Developed High Power Rocket

(Technical Report)

Evaluation of Risk Perception Asymmetry in the Commercial Airline Industry

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Executive Summary

Risk is an ever-present part of life, and learning how to assess and mitigate risk on both a technical and ethical level is an essential aspect of engineering. My technical research examined the design and fabrication of a coupler and separation system for a Student Research and Design (SRAD) high powered rocket and its integration into the larger rocket assembly. This design project served to provide invaluable experience in both project management and real-world design and fabrication as a culmination of my studies at the University of Virginia. My sociotechnical research examined the asymmetrical nature of risk and its communication within the airline industry. This research subject was chosen to gain insight into the antiquated aspects of the aerospace industry and explore the possibility of systemic change in a modern world. For my technical research, I was constantly required to make decisions based on risks to the project and the safety of a potential launch. Through the case study of my technical research, I was able to explore how risk is perceived and evaluated from both engineering and non-engineering perspectives.

The study of an SRAD high powered rocket provided the unique opportunity to innovate in design as an extension of prior studies while gaining practical experience in fabrication and integration. The guiding characteristics in undergraduate engineering studies is the construction of a formal basis of knowledge, often utilizing simplifying assumptions and idealizations. The aerospace design capstone served as a culmination of these studies while also incorporating the more practical and nonidealized aspects of design and project management. This research required us to perform all aspects of the design, evaluation, and review processes with the goal of fabrication and launching of the entirely student-made rocket system. My responsibility in this

research was the design and integration of a coupler system to facilitate the controlled separation of the rocket in-flight.

The research of an SRAD rocket system culminated in the fabrication and integration of individual components, with the goal of a test launch being relinquished for safety and liability purposes. By forgoing an actual launch, we were able to avoid compromises in design that would have undermined the SRAD aspect of our design and ultimately achieved a more robust and ambitious design. Throughout the design process, I was required to be both highly adaptable and accountable in my design choices due to the changing requirements associated with the project, and I gained invaluable experience in component integration and project management.

My sociotechnical research focused on the asymmetric power dynamic between airlines and passengers in the assessment and mitigation of risk and the resulting consequences for industry in our modern world. Air travel features unique characteristics that separate it from other modes of transport and serve to disincentivize systemic change and modernization regarding risk, ultimately exacerbating the asymmetry between airlines and passengers and undermining the long-term stability of the industry. I examined this argument through a literature review of risk and transportation through the lens of Actor-Network Theory.

My research in this area found that the perception of risk and how it is mitigated differs drastically between airlines and their passengers, and this discrepancy ultimately leads to alienation and a dysfunctional industry model. Through socially driven systemic change, it could be possible to promote long term proactive changes to how risk is accessed and communicated in order to promote more sustainable and ethical business practices in the airline industry, as well as the aerospace industry at large.