

Measuring Airport Similarity to Create a Towering Decision Aid
(Technical Report)

A Virtue Ethics Analysis of the Boeing 737 MAX Design
(STS Research Paper)

An Undergraduate Thesis Portfolio

Presented to the Faculty of the
School of Engineering and Applied Science
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In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Systems Engineering

By

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Socio-Technical Synthesis: Improving Aviation System Safety

My technical project and STS research paper are connected through the area of aviation safety. Improving aviation safety through both the design of aircraft and construction of air traffic control towers saves lives as well as billions of dollars in prevented damage. My technical project studies aviation safety in addition to economics and efficiency at the airport and air traffic level, while my STS research paper studies safety from the aircraft and aircraft design perspective. However, both elements are integrated into the overall aviation system, and studying both are necessary to improve aviation safety.

My technical work focuses on quantifying airport similarity in order to build a decision aid for airports looking to build air traffic control towers. My team focused our analysis on three aspects of airport data, including safety, economic, and efficiency metrics. Using this data, we performed hierarchical clustering to study which airports had similar characteristics, and which metrics were most important in determining similarity. From this analysis, we built an interface where airport stakeholders can input their own data points to see which airports are similar to their own airport. We hope by completing this project to provide more information to airports looking to build air traffic control towers and guidance on further studying on the benefits of air traffic control towers.

The STS component of my thesis also involves aviation safety, but from an aircraft level perspective. As a case study, I look at the design and subsequent fatal crashes of the Boeing 737 MAX aircraft. My research focuses mainly on the designers of the Boeing 737 MAX aircraft, and how they behaved unethically. Using the framework of virtue ethics, I argue that the

designers of the 737 MAX violated the virtues of foresight and holistic thinking, in turn making their behavior unethical. These specific virtues were important in understanding how the design was inherently unsafe and too risky to fly. My paper explores this idea, as well as how engineered systems need to be viewed from a whole system viewpoint in order to prevent catastrophes such as the crashes of the two 737 MAX aircraft.

Working on both of these projects at once provided plenty of additional insight and value. My technical work introduced me to several aviation data sources, including the ASRS, which proved to be a valuable primary source for my research paper. Similarly, my research paper provided insight into the aviation regulation process, and helped understand why the guidelines for building an air traffic control tower are so outdated. Working on the research paper motivated me to work more on the technical project to aid in updating legislation to prevent more catastrophic accidents. In conclusion, working on both the technical project and STS research paper have allowed me to study aviation safety from multiple dimensions, and further understand the socio-technical aspects of my engineering work.