

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

**Delegation and the Culture of Complacency in Air Traffic Control Systems**  
(STS Research Paper)

An Undergraduate Thesis Portfolio

Presented to the Faculty of the  
School of Engineering and Applied Science  
University of Virginia, Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree  
Bachelor of Science in Engineering Systems and Environment

By

Amy Xie

May 7, 2020

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Name: Amy Xie  
Date: 21 April 2020  
STS 4600

## Socio-technical Synthesis: Air Traffic Control and Aviation Safety

My technical and science technology and society (STS) projects both address aspects of the socio-technical problem of improving aviation safety. The technical project focuses on establishing a method to understand the benefits of airport traffic control towers (ATCTs), and the STS project analyzes how technology as a script plays a role in the culture of complacency in air traffic control (ATC) systems. While each project approaches ATC technologies from a different angle, the theme and overarching goal of improving safety in aviation is consistent across both projects.

The technical project creates a new method to quantify the benefits of an ATCT. It delivers this through a decision aid tool that returns a list of similar airports along with a visualized comparison of metric performance for any combination of inputted data. This tool was developed entirely from scratch. My capstone team decided on the safety, economic, and efficiency metrics, gathered data on these metrics for as many airports as possible, ran statistical analyses and clustering on the data, and built the front-end interface that displays the output. Because we created the database, code, and interface separately, it allows for the tool to be dynamic and to be updated as necessary. The goal of our tool is to serve as an informative and up-to-date decision aid for airports that are looking to establish a tower.

The STS project also focuses on ATCTs, but explores how it is not enough to simply rely on an ATCT for aviation safety. My research uses the Air Canada flight 759 (ACA759) near-miss incident at the San Francisco airport (SFO) to analyze the culture of complacency in aviation. By exploring two sub-networks, the SFO ATCT and the ACA759, within the larger

SFO ATC system, it is evident that the role of technology in the issue of complacency is overlooked by the FAA. The STS project uses Bruno Latour's concept of delegation to understand how the reciprocal relationship between social and technical actors played a role in undermining the goal of the SFO ATC system to ensure safety within and surrounding the area of the airport.

Working on both projects simultaneously provided a more rounded understanding of the issues in aviation safety. The technical project allowed me to better understand ATC systems and the functions that ATCTs are responsible for. It has required in depth research on the different metrics that are important to consider when deciding to establish a tower, and has shed light on how the current criteria is biased and ineffective. However, an updated decision aid will not be sufficient to accomplish the goal of aviation safety, and the STS project provided a further understanding of why this is the case. Analyzing the Air Canada near-miss incident provided a different perspective on the current vulnerabilities of an ATC system. When working on the technical project, it is easy to fall into the mindset that if ATCTs are more efficiently constructed at airports that will benefit greatly from them, then safety will be achieved. Working on the STS project alongside the technical project provided a constant reminder that there are many social factors that also need to be considered. Overall, the closely linked nature of the projects meant that research for one was research for both, just from different angles, and working on them simultaneously allowed for a more comprehensive understanding of each.