Thesis Project Portfolio

Low Rider

(Technical Report)

The Politics of Aircraft Investigation and Innovation

(STS Research Paper)

An Undergraduate Thesis

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Daniel Scott Lattari

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Department of Mechanical and Aerospace Engineering

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Executive Summary

In order to better understand the design requirements needed to innovate a certification intensive industry, the design aspect of this thesis will study the many facets that go into such an innovation. The American Institute of Aeronautics and Astronautics' 2022 design challenge requires just that. Given a list of aircraft characteristic limitations, teams are expected to design an aircraft that is capable of flying fifty passengers up to 1000 nautical miles. The caveat is to do so while implementing a flight architecture that has yet to be fully understood: hybrid electric turboprops. This describes an aircraft that uses conventional internal combustion engines and an electrically powered propulsion system. Today, the regional turboprop market is dominated by a few players: Aerei da Trasporto Regionale (ATR), Embraer, Bombardier, and De Havilland Canada (owned by Longview Aircraft Company) to name a few. While ATR and De Havilland Canada are the largest actors in the market, they both introduced their current repertoire of turboprops in the mid-1980's. As the market continues to expand and the technology continues to age, airlines and regional aircraft manufacturers will need to innovate to meet the demands of both their customers and the environmental revolution that is being realized across the globe (Justin Hayward). Hybrid-electric regional turboprop planes will be the first to take up our efforts against climate change, hopefully as soon as 2030.

With mostly outdated technology and flight requirements which are less demanding than that of large commercial jets, an interesting experimental testing ground has emerged for the next generation of aircraft, a generation which will be defined by its environmental impact. For the industry as a whole, the advancements made in the regional turboprop sector will be monumental in the evolution of larger aircraft. In our current understanding of hybrid technology, any solution for larger planes would require huge amounts of weight to be added, providing little additional

benefit. While these larger aircraft are mostly responsible for the enormous amount of carbon dioxide released by planes each year, it is nonetheless beneficial to improve our understanding and use with hybrid-electric planes now on smaller aircraft, as to better integrate this machinery once the accommodating technology is readily available for use on larger aircraft. This challenge aims to not only engage our team's problem solving skills but also our understanding of mission requirements, design tradeoffs, and public perception of aircraft. It is vital that our designs uphold both the challenge's quotas and the needs of anyone who would be flying on such an aircraft. This challenge is more than a thought experiment, but an all encompassing design and administrative task to test our ability to turn an outlandish, futuristic idea from the drawing boards into a tangible model that can be described by mathematical principles and models. Yet, despite the freedom to design the aircraft how we would like, there are a multitude of FAA certifications and regulations that the team must consider and work around to find a solution to implementing their conceptual aircraft. This introduces politics into the equation.

Since its inception in 1914, the commercial aviation industry has revolutionized the way in which society functions today. In the United States alone, nearly 1.7 million passengers entrust their lives to the engineering feats of aviation everyday. According to the Department of Transportation, air travel is the safest mode of transportation. However, this is in large part due to the mistakes which have been made over the past century and the ways in which they've been resolved. Whenever a tragedy involving aircraft occurs, two things are sure to follow: an investigation and innovation. Yet, with these there are intrinsic politics not too dissimilar from that which may be experienced in the House of Representatives or the Senate. When a billion dollar industry is met with a death toll: lobbyists, corruption, and red herring will, and have, undertaken the justice system. Despite this, aircraft have been shaped by these disasters, making

the skies safer for all who fly today. So what are these politics? And how have they led to the safest transportation network enjoyed by modern society? These questions are crucial to understanding the diffusion of not just aircraft into society, but any technology that holds human life in its hands. This thesis will explore these questions and discuss how the tragedies that have occurred in the commercial aviation field have led to the innovations which make flying reliable today. Through three decisive incidents, the Boeing 737 max incidents, Zagreb mid-air collision, and Alaska Airlines flight 261, the political nature of aircraft investigations, and the improvements made to commercial aircraft through them will be apparent.