Thesis Project Portfolio

Hybrid Electric Regional Turboprop Aircraft

(Technical Report)

The Impact of Rising Jet Fuel Prices on Global Connectivity

(STS Research Paper)

An Undergraduate Thesis

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Catherine DeScisciolo

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Department of Mechanical and Aerospace Engineering

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Sociotechnical Synthesis

Regional turboprop aircraft typically seat 50-70 passengers and are used for short-haul, domestic flights. The current regional turboprop market is dominated by designs created 40 years ago. These models have inefficient fuel burn and, as a result, high levels of direct emissions such as CO2 and NOx. My capstone research group is creating a hybrid electric regional turboprop aircraft that reduces block fuel by 20% and reduces emissions in comparison to current models. The aircraft will carry 50 passengers, be capable of flying a 1000 nm mission, and aims to be ready for an entry into service date of 2035. Regional turboprops are capable of navigating short, rugged runways giving them access to many airports larger, jet-engine aircraft cannot. Turboprops are vital to keeping those areas connected to the rest of the world physically and economically. Additionally, hybrid vehicles which use batteries as an alternative source of power often require the mining of heavy metals, which is detrimental to both the health of the planet and of the workers involved. As such, it is important to consider other power sources which are safer to obtain and more environmentally friendly. Our design must consider these factors to be a successful replacement for current models from a human and social perspective. Technological stabilization and technological momentum are good lenses through which to analyze the problem-solving approach. Aspects of aircraft design have become standardized over time; hence why older regional turboprop models still dominate the market today. There is nothing inherently wrong with the physical design of current aircraft, but with increasing environmental standards and awareness, the fuel burn and emissions need to change with the times. My STS research is focused on how the rising price of jet fuel has decreased global air connectivity. Through literature review, document analysis, and policy analysis I aim to investigate how various areas of the world have suffered economic declines from decreases in tourism and international trade due to jet fuel prices during and after the COVID-19 pandemic. Airline companies have taken cost-cutting measures to combat both the high price of fuel and the pandemic, resulting in a loss in the number of unique city-city pairs and international trade potential. My STS research will reveal gaps in the aviation market which could be remedied by my technical design research.