

**(Un)Sustainable Aviation**  
**Complex Interactions in the Quest for Green Flight**

**A Research Paper submitted to the Department of Engineering and Society**

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**In Partial Fulfillment of the Requirements for the Degree**  
**Bachelor of Science, School of Engineering**

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**On my honor as a University Student, I have neither given nor received unauthorized aid  
on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments**

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Engine technology has always existed at the forefront of new aerospace systems that revolutionized transportation. The technology used in the F-1 engines that brought the first astronauts to the moon was developed years before the first Saturn V rocket was created. A leap in technology in jet engines allowed designers to create the 747 - the world's first “jumbo-jet.” The 747 was an aircraft of scale previously unimaginable, now affectionately known as the “Queen of the Skies.” This was an aircraft that helped open up air travel to everyone. The aircraft of tomorrow will depend on new propulsion technologies made today. My research will look at both technological advancements in aerospace propulsion and societal factors impacting the development of such technologies.

In the technical portion of my research, my team and I designed and manufactured a hybrid rocket engine. Hybrid engines combine the safety of liquid engines with the simplicity of solid motors. However, in industry, they remain a relatively unexplored field. These engines are limited by the traditional manufacturing techniques used to create injector and fuel grain geometries. Because of this, our team utilized advanced manufacturing techniques such as stereolithography (SLA) printing to create and iterate on optimized injectors and fused deposition molding (FDM) printing to test multiple fuel grain structures.

In the STS portion of my research, I examined the complex landscape of sustainable aviation efforts through Actor-Network Theory (ANT). First, I analyzed the current landscape of climate change and the increasing demand for commercial aviation. Then I looked at the interactions between legislation, geopolitics, democracy, and industry and how they impact sustainability.

In analyzing these topics, I realized the complex web of interactions governing advancements in the aerospace industry. Not only is technological advancement necessary to

develop new technologies today to create a greener aviation industry, but it is also necessary to create a conducive environment for this innovation through good governance structures, legislation, education, and collaboration with industry.