

**Thesis Project Portfolio**

**Hypersonic ReEntry Deployable Glider Experiment**

(Technical Report)

**Actor Network Theory Analysis of SpaceX's Success in the Space Industry**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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## **Table of Contents**

Sociotechnical Synthesis

Hypersonic ReEntry Deployable Glider Experiment

Actor Network Theory Analysis of SpaceX's Success in the Space Industry

Prospectus

## **Sociotechnical Synthesis**

My technical work and my STS research are connected primarily through the changing dynamics of the space industry, and exploring what implications it has for the future of technology.

However, the two works differ in the ways that the space industry is changing. My technical work focuses on the technological advancements in space technology, whereas my STS research explores the economic and organizational changes in the industry. So, while my technical work and my STS research approach the space industry from different angles, the theme of the changing dynamics in the industry is consistent across both projects.

My technical project proposes the idea of a hypersonic glider experiment with the intent of collecting data on re-entry conditions. My capstone team has developed a CubeSat that will reconfigure itself into a hypersonic glider once it is released into a low-earth orbit from the second stage of a rocket system. Once the glider re-enters the Earth's atmosphere, its shape will help it maintain hypersonic flight and prevent the craft from slowing down due to drag. While re-entering, the craft will send telemetry of various pressure, temperature, and aerodynamic measurements at hypersonic conditions. While the craft needs to survive long enough to communicate data about re-entry conditions, it must burn up during flight. Our project culminated in a preliminary and critical design review and will seek funding for future capstone teams to launch our craft. Our design serves to demonstrate the feasibility of low-cost hypersonic flight on small-scale re-entry vehicles as well as to further the advancements of hypersonic research, which has become a growing interest in the aerospace industry for defensive and commercial purposes.

My STS research also explores the changes in the space industry, but from an economic and organizational perspective. My research focuses on the privatization of the space industry in

the twenty-first century, with a focus on how SpaceX became a leader in the industry. I considered the decentralization of NASA after the Apollo-era and the economic barriers NASA faced as contributing to the privatization of the space industry. However, by employing Michel Callon's iteration of actor-network theory, I developed my ultimate claim that tensions between the US and Russia, and concerns over state funding are the primary reasons why SpaceX was able to become a leader in the industry. By determining each of the human and non-human actors involved in SpaceX's actor-network, I establish tertiary actors that are vital for the success of this company. The goal of my STS research is to push the understanding of how technological advancement can be affected by various external factors.

Working on these two projects simultaneously greatly added value to both. As I was working on the second stage of the hypersonic research project, tradeoffs between the ideal design and budgetary restrictions were encountered often and provided me with a greater understanding of the logistical and technical challenges companies in the aerospace industry face. Additionally, my actor-network theory analysis of how SpaceX became a leader in the industry helped me better identify the factors that affect aerospace companies and the challenges they face. In conclusion, exploring the aerospace industry from multiple angles at tandem has allowed me to have a greater understanding of what I am studying and improve the quality of both of them.