Thesis Project Portfolio

Student Researched and Developed High Power Rocket

(Technical Report)

Understanding the Social Impact and Global Consequences of Space Exploration

(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

Christopher Carlos Camacho

Spring, 2024

Department of Aerospace Engineering

Table of Contents

Executive Summary

What does it mean to enter the field of rocketry in the modern age? With our technical subject, the creation and launch of a high-powered rocket for data collection, this is a question that holds relevancy for those of us hoping to progress to industry-level rocketry. This project serves as a learning experience for the planning and execution of a design process from start to finish. With my STS research, I hope to show the environment that exists for those that hope to complete projects in industry and the implications of being associated with the field of rocketry today. Comparing this university level project to the atmosphere of industry is the aim of my paper, something that will give university students more perspective to the current climate of their prospective future.

Understanding the design process is easiest done with hands-on experience. Our Rocketry Capstone serves this end by allowing students to collect research, create prototypes, and follow through on each step of the design process. In our Capstone we had free reign to designate teams, assign members, discover project priorities, and practice communication within our own teams and with other teams. Allowing students to experience this right before their transition to the real world creates an atmosphere where they can assess, learning whether they like or dislike it and how to maneuver through it, whether its interacting with peers or administration.

At the conclusion of our Capstone, I have discovered that the environment of research and development is very reliant on the effort and quality of both teammates and administration. In other fields, the assignment relies on your quality of work and is mostly detached by the concurrent effort of another peer, but in research everyone affects each other during the process. Also, objectives set out at the beginning of the capstone were sometimes on the mark, but sometimes were conceived in naivety and had many more parts for accomplishment than we

thought while coming up with our goals. The progression in the creation of a functioning highpowered rocket was great, especially with it being started from scratch and many setbacks. My goal of creating a functioning telemetry system and prototype code was successful.

With my research, I hope to connect someone's personal experience with invention to the question of what the current climate of invention and advancement is in the industry-level bubble of rocketry. I believe that understanding the interaction of one's potential discoveries politically, economically, and socially is very important, as I'm sure in the pursuit of science in making the atomic bomb, Oppenheimer was not aware of the permanent impact that it would have. With the seemingly new frontier of occupation and combat being our orbit, planets, and beyond, I believe that understanding the full impact one might have is critical for students entering the industry.

Creating a collection of the history surrounding space exploration, the laws created to manage it, and its current state allows for students to have a full perspective of what they are getting themselves into. After writing my paper, I have come to the conclusion that the current state of space exploration has deviated from its original use of fair use for every nation on Earth, especially with the emergence of commercial uses that are being pursued by private sector billionaires. Countries without the inherent capabilities to occupy orbit or explore space must rely on other nations for these capabilities, while some do not even hold the power to utilize any assistance due to their own circumstances within the country. The advancement into space can yield great things for humanity, but seemingly will be best utilized by the rich and powerful.