

Thesis Project Portfolio

Hypersonic ReEntry Deployable Glider Experiment (HEDGE)

(Technical Report)

**What are the Current Attitudes of the Public Towards the Private Sector's Outer Space
Tourism Technology?**

(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

Arlee Christian

Spring, 2024

Department of Mechanical and Aerospace Engineering

Table of Contents

Executive Summary

Hypersonic ReEntry Deployable Glider Experiment (HEDGE)

What are the Current Attitudes of the Public Towards the Private Sector's Outer Space Tourism
Technology?

Prospectus

Executive Summary

Technical Project

The technical project portion of my thesis outlines the development of the Hypersonic ReEntry Glide Vehicle project (HEDGE). HEDGE is known as a CubeSat, which is a nanosatellite that has a specific standard dimension so that it can easily be launched from space. This project aims to demonstrate the feasibility of using CubeSats for low-cost hypersonic glider flight experiments. The project is initiated by undergraduate students from the University of Virginia's aerospace and mechanical engineering departments. The primary goal of this project is to show that hypersonic flight experiments can be conducted by undergraduates using CubeSats at a lower cost and with greater accessibility compared to traditional methods.

The six different functional teams involved in the development of HEDGE included Project Management, Structures and Integration, Software and Avionics, Communications, Attitude Determination and Control Systems (ADACS) & Orbits, and Power, Thermal and Environment team. Each of these functional teams include a detailed description of what was accomplished by their team and how it contributed to HEDGE. The operational design requirements and mission constraints are outlined in order to ensure the vehicle's functionality and adherence to the set standards. Various components such as the fins, solar panels, nose cone, and internal layout of the spacecraft are described, along with their design considerations.

STS Project

My STS project provides a comprehensive investigation into the current social attitudes towards space commercialization by private companies. The project focuses specifically on Blue Origin's recent commercial space flights with their rocket, New Shepard. The aim of the research

is to investigate public opinions on the recent massive increase in the space tourism market by billionaire-owned private companies. The approach I used in this investigation included analyzing some public figures commentaries, conducting an in-person interview with an Amazon employee, and examining US citizen survey data from the Pew Research Center. The critical discourse analysis (CDA) framework is employed to understand the social and cultural context surrounding the language used to discuss space tourism.

The results indicate a polarized public opinion, with some supporting space tourism as a means of exploration and others criticizing it as elitist and environmentally damaging. Jeff Bezos' post-flight comments thanking Amazon customers and employees sparked controversy, especially amid the backdrop of the COVID-19 pandemic and widening wealth inequality. Survey data suggests a split in public opinion regarding the future of space tourism, with younger generations more interested, but also more critical of billionaire involvement. The research concluded that opinions on space tourism are influenced by socio-economic background, relationship with billionaires, and perceptions of wealth inequality. While some see the potential for job creation and technological advancement, others view space tourism as exacerbating existing social disparities. The research highlights the importance of public perception in shaping the future of space tourism.

Relationship

These two projects examine similar aspects about space and space travel. The technical project focuses on the development and construction of a hypersonic spacecraft. The purpose of the project is to show that hypersonic flight experiments can be conducted by undergraduates using CubeSats at a lower cost and with greater accessibility compared to traditional methods.

Hypersonics research is important because it will define our future in both commercial air travel and space travel. This is similar to how space tourism and the public's perception of it will define our future in space. The STS project focuses on how people view and think about space tourism, especially since it is a relatively new industry that billionaires have been deeply involved in promoting. Hypersonics is another industry that the United States has recently been actively pursuing, partly for the development of hypersonic weapons. While the direct relationship between hypersonic CubeSats and space tourism is not immediately apparent, the development of these small satellites could have far-reaching implications for the broader space industry, including many aspects that are related to space tourism.