Thesis Project Portfolio

HEDGE

Hypersonic ReEntry Deployable Glider Experiment Critical Design

(Technical Report)

Effect of Diffusion Innovation on Emerging Countries:

Brazil Case Study

(STS Research Paper)

An Undergraduate Thesis

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

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Bachelor of Science, School of Engineering

Joseph Lee

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Department of Mechanical Engineering

Table of Contents

Sociotechnical Synthesis

Technical Research Paper

The technical paper focuses on the Hypersonic ReEntry Deployable Glider Experiment (HEDGE), a CubeSat designed to take external pressure to calculate hypersonic speed while withstanding environmental factors. The paper goes over the mission's statement and objective. Key objectives are low-cost operations, undergraduate students' capability for hypersonic research, and the feasibility of CubeSat for hypersonic experiments. It also states the necessity of the project and the impact it could have on a nationwide scale, as the cost of HEDGE is only a fraction of a typical hypersonic research cost. Following these statements, the launch process is explained in a detailed description, starting from the launch site to the reentry burnup. The functional and design requirements soon follow after. The proceeding portion of the paper goes through each subsystem of the spacecraft. The subsystems are in the following order: Communications; Software and Avionics; Attitude Determination and Control Systems and Orbits; Power, Thermal, and Environment; and Structures and Integration. Each subsystem explains its design requirements, a summary of significant subsystem elements, selected components and justification, subsystem assembly detail, and analysis and calculations (if applicable). The section after each subsystem's explanation is the Management, Team Roles and Responsibilities, Meeting, Collaboration, Reporting, and Reviews, which goes over the structure of each subsystem in terms of personnel. There is also a program management team that ensures subsystems are going according to plan; are within the budget; are within laws regulated by federal and international agencies; and are effectively sharing even workloads. They also cover the structure of how the class runs and the detail of the schedule for the CubeSat. The schedule for the CubeSat to launch is in the 3rd quarter of 2024, which is an exciting prospect nonetheless.

The remaining sections are the budget breakdown and conclusion. The goal budget for the HEDGE is somewhere in the $200,000 range. It concludes with remarks on the challenges that are still ahead and the steps they will take to overcome them in the future.

STS Research Paper

The research portion of the paper will focus on the diffusion of innovation in emerging countries. The paper initially focuses on the purpose of the paper, which is to explore how innovation has been implemented in emerging countries and to what extent they have an impact. Overall, this topic is essential to cover as countries worldwide are becoming more technologically advanced, and engineers, as innovators, should be more aware of how they can impact the world. The paper then explains why it uses the SCOT framework, a case study, to explore this paper's topic. At this point, the paper reveals that Brazil is the main subject of the case study. The introduction concludes with the paper's thesis, which becomes the main focus. The paper then explains the background of Brazil from a cultural standpoint as well as a historical standpoint. It is important to note that Brazil was a Portuguese colony that got its independence in the 1800s. Even after their independence, the Brazilian nation faced obstacles that impacted them into the 20th century. Part of what allowed them to advance as an overall country was innovation. The following section was definitions. The four terms defined were innovation, innovation systems, globalization, and diffusion of innovation. Various authors defined each definition. A significant portion of the paper is the literature review it does. The review spans different outlets and forms of information. In the first article, Winter shows how technology plays an influential role and how the system and the inventor ultimately place those influences. Aslam's globalization article lays a foundation for innovation.

Casadella's Mint case lays a foundation for emerging economies. Reddy's BRIC focuses on the broad scope of Brazil as an emerging economy, along with case studies. Koeller's Brazil's innovation focuses on the shortcomings of these innovative systems implemented in Brazil in the past. Rodríguez-Morales explores the sugar cane industry and shows how the government, as does the private sector, plays a heavy role. Dorè's journal focuses on the ups and downs of Brazil's government through the lens of a historical timeline but breaks down the sections by government. Vieira's journal focuses on the agricultural sector and how government initiatives led to the government learning diffusion science. The analysis goes over the common factors that were seen through the literature review and makes a recommendation regarding each factor. The conclusion finally states that the study of diffusion of innovation through Brazil leads to a flexible framework applicable to other emerging countries.