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Indigenously Developed Sounding Rocket

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Abstract: *This research paper details the development, and preliminary evaluation of an indigenously developed sounding rocket powered by a solid propulsion system. The project is motivated by the need to create a low-cost, modular platform for scientific payload delivery to suborbital altitudes, with a target maximum altitude of 5 kilometers. The rocket is intended for applications such as atmospheric sampling, microgravity experiments, sensor testing, and as a foundational step toward more advanced launch vehicle development.*

The propulsion system utilizes a solid composite propellant, chosen for its relatively simple manufacturing process, storage stability, and suitability for experimental rocketry in developing environments. Key aspects of the rocket's design—including motor geometry, nozzle configuration, airframe materials, and stabilization mechanisms—are discussed in detail. The vehicle employs a spin-stabilized configuration to enhance flight stability and reduce the complexity of active control systems.

While full-scale flight testing has not yet been conducted, the development process included thorough analytical modeling, tests, and computational simulations using both open-source and custom-developed tools. These simulations were used to predict thrust curves, burn time, structural loads, aerodynamic performance, and altitude profiles. Ground-based tests confirmed the viability of the motor design and overall structural integrity under launch conditions.

This paper also outlines challenges faced during the development process, including limitations in fabrication resources, material sourcing, and test infrastructure. Despite these constraints, the project demonstrates the feasibility of grassroots aerospace initiatives and serves as a proof-of-concept for future experimental flights. The outcomes contribute to the growing field of accessible rocketry, particularly in regions with emerging space capabilities. The research establishes a foundation for continued testing, iterative design improvements, and eventual real-world deployment.

Keywords: propulsion system

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