Paper ID: 100832
student

53rd IAF STUDENT CONFERENCE (E2)
Interactive Presentations - 53rd IAF STUDENT CONFERENCE (IP)

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IMPLEMENTATION OF WINGLET STRUCTURES IN HIGH-POWER EXPERIMENTAL ROCKETS FOR THE NATIONAL MEETING OF SPACE RESEARCH AND EXPERIMENTATION (ENMICE) COMPETITION.

Abstract

This study investigates the integration of "Winglet" structures into high-power experimental rockets to enhance their aerodynamic efficiency and overall performance. The primary focus is on the reduction of aerodynamic drag, which can significantly increase the achieved altitudes and maximum speeds. Additionally, the implementation aims to improve the rocket's stability and control during the initial flight phases, contributing to safer and more accurate launches. This development was created specifically for the National Meeting of Space Research and Experimentation (Encuentro Nacional de Investigación y Competencia Espacial, ENMICE) contest in Mexico, organized with the support of the Agencia Espacial Mexicana. The project methodology encompasses theoretical research, computational simulations, and empirical testing. Prototypes of Winglet structures were designed and fabricated using aerospace-appropriate materials. These prototypes underwent rigorous physical tests and experimental flights to collect precise data, which was then thoroughly analyzed. The key objectives include minimizing aerodynamic drag to boost rocket performance and evaluating the potential for more fuel-efficient flights, which could positively impact environmental sustainability. This research represents a notable advancement in experimental rocket development, offering potential benefits to both the scientific community and the aerospace industry by improving the efficiency and capabilities of high-power rockets. Data gathered from physical tests and subsequent experimental flights demonstrate the Winglet structures' effect on aerodynamic drag reduction, altitudes, maximum speeds, and overall flight stability and control. The project structure and development, tailored for the ENMICE competition, provide insights into the feasibility and effectiveness of Winglet implementations in high-power rockets, potentially influencing future rocket designs and launch strategies within the aerospace sector.