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A SMALL LAUNCHER INCLUDING A DUAL MODE RAMJET AS SECOND STAGE

Abstract

This paper explores the feasibility of achieving rapid and frequent access to space for small satellites in Low Earth Orbit (LEO) by incorporating a dual-mode ramjet as the second stage. The integrated solid rocket-dual mode ramjet-solid rocket combined engines aim to capitalize on the benefits of both a rocket engine's high thrust-to-weight ratio and an air-breathing engine's high specific impulse. The vehicle design is based on a novel hypersonic vehicle sizing approach, emphasizing energy management and propulsion system integration. The approach aims to identify the optimal configuration for highly integrated lifting bodies and propulsion systems. The convergence solution space, linking vehicle mission requirements to aerodynamic and propulsion efficiencies, addresses the challenges of hypersonic launchers. Mission analysis will be instrumental in determining the optimal engine range of operation in terms of Delta-V and altitude per stage.

The three-stage launcher is designed with a solid booster, a dual-mode ramjet, and a hybrid rocket as the first, second, and third stages, respectively. The third stage remains an integral part of the airbreather stage's payload bay until it reaches launching conditions. Subsequently, the final stage propels the satellite into its designated orbit upon reaching the predetermined altitude.