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ACCOMPANIED LAUNCH EARTH STATION TO INNOVATE AND FACILITATE THE TAKEOFF OF SPACE ROCKETS

Abstract

The high fuel consumption and aerodynamic resistance during the initial phase of rocket launches represent critical challenges for the efficiency and sustainability of space systems. This paper presents the conceptual design of an Elevated Ground Launch Station (EGLS), an artificial elevated structure equipped with a linear electromagnetic acceleration system designed to provide an initial boost to the rocket before the ignition of its main engines. Using levitation and magnetic acceleration technologies, similar to those used in high-speed trains and projectile accelerators, the EGLS aims to optimize the rocket's transition into the upper atmosphere, reducing fuel consumption and improving structural efficiency.

The design of the EGLS is based on previous studies of electromagnetic accelerators and assisted launchers, such as experiments with SpinLaunch and high-speed launch rails. Simulations using computational fluid dynamics software and structural analysis have been conducted to evaluate the system's feasibility, considering factors such as energy dissipation, the stability of the superstructure, and the effects on the rocket's trajectory. Preliminary results suggest that this system could reduce fuel consumption in the initial phase by up to 20

Unlike conventional launch systems, the EGLS would enable a significant reduction in the use of massive terrestrial infrastructure, lowering operational costs and increasing launch frequency. Its implementation could be integrated with existing rockets without major modifications, positioning it as a viable medium-term alternative for low Earth orbit missions and beyond. Although technical challenges remain, such as generating and distributing the energy required for electromagnetic acceleration, structural stability, and optimizing the flight profile, this paper proposes a small-scale experimental prototype to assess the technical viability of the EGLS.

The results obtained so far indicate that integrating electromagnetic acceleration technologies into elevated platforms could represent a significant advancement in optimizing space launches. It is recommended to continue experimental studies and collaborations with universities and research centers to develop small-scale tests and validate the benefits observed in computational simulations.