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DESIGN AND PROGRESS OF A LOX/METHANE REUSABLE COMMERCIAL LAUNCH VEHICLE

Abstract

A medium-sized reusable commercial launch vehicle is currently under development to address diverse requirements in both the Chinese and international launch markets, including low Earth orbit communication constellation deployment and cargo spacecraft launches. The launch vehicle adopts a two-stage configuration, with both stages utilizing liquid oxygen methane (LOX/methane) as the propellant. The first stage incorporates nine engines, each with a thrust level of 80 tons. Meanwhile, the second stage features a modified vacuum engine optimized for space conditions. To reduce launch costs and enhance market competitiveness, we employ first-stage reusability technology. After vertical landing, the first stage undergoes minimal maintenance and refurbishment, enabling rapid execution of subsequent launch missions. The minimum planned reuse count for the first stage is 20 times. The variable-thrust engine, characterized by a high thrust-to-weight ratio and deep throttling capability, achieves electrical integration, which enables intelligent control capabilities, supporting multiple restarts. To enhance launch and flight reliability, the rocket incorporates hold-down release mechanisms, fault diagnosis systems, online reconstruction of guidance and control, and propulsion redundancy. Considering the characteristics of liquid oxygen methane, capacity requirements, and engine thrust, the rocket adopts the configuration with a takeoff weight of more than 500 tons and a diameter of 4-meter class. Following three years of detailed design and extensive ground testing, the maiden flight is scheduled for 2025. This research contributes significantly to the advancement of reusable launch vehicle technology, paving the way for more efficient and sustainable access to space.