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DESIGN OF A LIQUID METHANE-OXYGEN ENGINE-BASED VTVL DEMONSTRATION ROCKET FOR REUSABLE LAUNCH VEHICLES

Abstract

Vertical takeoff, vertical landing (VTVL) technology is currently the most promising and feasible approach for achieving reusable launch vehicles. To validate this approach, a full-scale demonstration and verification rocket made of stainless steel and capable of flying at an altitude of over 10 km is under development, using a methane-oxygen variable thrust engine as the propulsion system. This will be the first Chinese VTVL demonstration and verification rocket with a diameter exceeding 4 meters. This paper presents the overall configuration of the rocket and flight test plan, as well as a comparison of different trajectory designs and a discussion of attitude control schemes under different trajectories. The aerodynamic characteristics of VTVL rockets have a significant impact on their attitude control and flight stability, and this paper provides an analysis of the aerodynamic properties of different designs and their influence on control capabilities. Finally, the paper also describes the designs of the liquid propellant tank and cabin structure of the rocket. The structural design of the tank and cabin section will be consistent with future reusable rockets. In addition, relevant ground tests and preliminary technical foundations are also introduced.