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A NEW THREE-STAGE-TO-ORBIT VEHICLE CONCEPT UTILIZING ROCKET-BASED COMBINED CYCLE PROPULSION

Abstract

To reduce the scale and lower the cost are the permanent goals of future launch vehicle designs. One well promising approach is to use airbreathing engines in reusable launch vehicles. This paper describes a new three-stage-to-orbit(3TSO) vehicle concept utilizing RBCC engine for LEO delivery mission. It consists of three stages propelled by a rocket booster, a RBCC vehicle, and a rocket vehicle respectively. All stages vehicles are reusable and return back to ground horizontally. The RBCC vehicle work through ramjet, scramjet and pure rocket modes and stage separation parameters with third stage vehicle is optimized to achieve higher efficiency and lower gross weight. Compared with the traditional two-stage-to-orbit(TSTO) concept, the proposed configuration is more suitable for RBCC propulsion. It has the advantages of lower gross weight, better economy and more technical feasibility. In order to evaluate and verify the performance of this concept,a numerical simulation is conducted. Furtherly, the comparison with other existing concepts is carried out for same mission requirements. The results indicate that the gross weight of the 3STO concept is less than that of other concepts and the payload mass fraction to 200km LEO orbit is up to 2.56%,which is significantly improved with respect to the current concepts.