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A NEW THREE-STAGE-TO-ORBIT CONCEPT UTILIZING RBCC PROPULSION TECHNOLOGY

Abstract

This paper describes a new three-stage-to-orbit concept utilizing RBCC engine for LEO delivery mission. It consists of three stages propelled by a rocket booster, a RBCC vehicle, and an expendable rocket vehicle respectively. All stages vehicles are reusable and return back to ground horizontally. Compared with the traditional two-stage-to-orbit(TSTO) RBCC vehicle concept, the proposed configure and its flight envelope are more suitable for RBCC propulsion. The three-stage-to-orbit concept can avoid large fuel consumption when the RBCC vehicle as the upper stage for injecting into orbit and high technology difficult when the RBCC engine used in the first stage which need support high thrust in the mode of eject.At the same time it also can take the advantage of muti-stage. Consideration of these factors, the designed concept has lower gross weight, better economy and more feasibility in technology. In order to evaluate and verify the performance of this concept,a numerical simulation is conducted. The separation point between 2nd and 3th stage is optimized to achieve lower gross weight. Compared with other existing concepts, consisting of three two-stage-to-orbit(TSTO) RBCC launch vehicle concepts and a fully three-stage-to-orbit rocket concept, an explanatory example is given to verify the beauty of the proposed concept.The comparison analysis is conducted in the same condition and the result of gross weight and other parameters are obtained. The result indicates that the gross weight of the 3STO concept is less than that of other concepts and the carrying coefficient(the ratio of payload's weight to gross weight) can reach 2.56