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A TWO-STAGE-TO-ORBIT HYPERSONIC VEHICLE CONCEPT UTILIZING RBCC PROPULSION TECHNOLOGY

Abstract

Owning to advantages of taking off flexibly, excellent reusability, safety, reliability, low launch cost and long life time, the new-generation space vehicles develop rapidly in recent years in all major space-faring nations, especially in America. As one of the propulsion systems, rocket based combined cycle (RBCC) engine has high specific impulse, high thrust and abilities of accelerating and cruising. Besides, it can work well through a wild envelop of mach numbers and angles of attack. So RBCC is the most perfect propulsion system for the new-generation space vehicles. The paper developed a space reusable launch vehicle (SRLV) concept. This SRLV is an unmanned horizontal take-off two-stage hypersonic vehicle based on the wave-rider-like configuration, utilizing RBCC as the primary propulsion system for the reusable booster stage. The SRLV is capable of supporting three different missions by configuring the expendable upper-stage with mission-specific hardware. The first mission is delivering space maneuvering vehicle (SMV) to orbit. The SMV is a reusable vehicle capable of remaining on-orbit for extended periods of time and features a small rocket engine for on-orbit maneuvering. The second mission is performing a hypersonic strike mission. The SRLV has very high velocity that it can fly to anywhere on the earth in very short time, making it the ideal platform for global strike. The last mission is delivering Cargo to the Low Earth Orbit (LEO). In this mission, the SMV is replaced with a similarly shaped payload fairing. Details of the conceptual design process used for the SRLV were included in the paper. The disciplines included aerodynamics, configuration, propulsion, trajectory and mass properties. Each of these disciplines was computed and analyzed and finally the integrated SRLV concept was formed.