Paper ID: 35805
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SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

Author: Dr. Jeyakumar D
Indian Space Research Organization (ISRO), India

SEPARATION DYNAMIC STUDIES OF A WING BODY HYPERSONIC RE-ENTRY TECHNOLOGY DEMONSTRATOR VEHICLE

Abstract

Separation dynamic studies play a major role in the success any space mission and it depends upon the collision free separation of spent stages during ascent. Recent years have seen an increasing interest of the space scientific community towards the development of hypersonic reentry vehicles. A generic RLV, which will be boosted by a solid rocket motor in ascent phase, is considered and it follows an un-powered descent during the hypersonic reentry phase. During the descent phase the vehicle glides without power and uses the aerodynamics of the vehicle to modulate the flight path for restricting the peak dynamic pressure and heat flux within the acceptable limits. It should be noted that the vehicle (RLV) is to be separated from the booster stage at the appropriate time. The inter stage along with the solid motor booster has to be separated from the vehicle at the desired altitude and at the desired Mach number. This paper provides studies on the selection of suitable separation system to achieve collision free separation of the continuing reusable wing body. Pyro-assisted split collet system is developed and qualified to achieve the physical separation. Different types of jettisoning systems were analyzed viz. spring thrusters, axial RCS thruster and retro rockets. The dynamics of the separating bodies under the influence of forces and moments are simulated and the state vectors are evaluated through integration of the governing equations of motion in the body frame. It was observed that two retro-rockets of 200kgf provide a collision-free separation and dispersion studies indicate availability of sufficient margin.