Paper ID: 12903
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SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Technologies (5)

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AEROTHERMODYNAMICS OF GENERIC REENTRY VEHICLE WITH A SERIES OF AEROSPIKES AT NOSE

Abstract

Reentry of a blunt nosed body is one of the most intriguing problems any space program. Especially in the light of various space tourism possibilities, there are many works concerning reentry of commercial blunt nosed space vehicles. In this paper, a blunt body reentry model based on Apollo program reentry vehicle fitted axisymmetrically with an aerospike at the nose is investigated numerically with commercially available control volume based full 3D multi-purpose flow solver ANSYS Fluent 13.0. The scaled down reentry model has a projected diameter of 39 mm and has a spherical cap of radius 36 mm. A 6 mm diameter aerospike fitted axisymmetrically at the nose has a hemispherical cap from which another aerospike of 4 mm protrudes which again has a hemispherical cap. A third aerospike protrudes from the cap of second aerospike. Different ratios of lengths of the three aerospikes and different diameters of the three hemispherical caps are investigated for their effect on the peak heat flux, total heat transfer rates and the overall drag of the reentry capsule. A two dimensional axisymmetric Navier Stokes Equations are solved for chemically reacting non equilibrium continuum hypersonic flow with freestream conditions of Mach No. 21.08 and a static pressure, altitude and temperature of 37.362 Pa, 55.842 km and 258.02 K respectively. The results are compared with that of reentry capsule without aerospike. This paper uses the simulation results to suggest an optimal design parameter for blunt bodies in reentry that can be used by craft intended for space tourism.