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AEROTHERMODYNAMICS OF A HEMISPHERICAL-CYLINDRICAL BLUNT VEHICLE WITH A FLOW THROUGH DUCT

Abstract

The most important problem in any spacecraft reentry mission is the analysis of aerothermodynamics of reentry conditions. One of the most commonly used shapes is the hemispherical – cylindrical blunt body concept. The aerothermodynamics of a hemispherical-cylindrical blunt body with a flow through duct is investigated numerically with a commercially available Computational Fluid Dynamics software package Ansys Fluent 13.0. The constant area circular duct starts at the nose of the axisymmetric model continues through the axis of the model and opens in the atmosphere at the base of the model. With the blunt body at zero degrees angle of attack the presence of stagnation point is eliminated. The effect of absence of the front stagnation point on the peak heat fluxes, total heat transfer rates and the overall drag is investigated in this paper. The projected cylindrical diameter of the reentry vehicle is 40 mm and total length of the vehicle is 100 mm. The diameter of diameter of the axial duct is varied from 10 mm to 30 mm. The freestream conditions used in the simulation are that of a typical point in the low lift ballistic reentry trajectory at an altitude of 30 km and a Mach number of 7.0. Real gas model for air is assumed without any chemical reaction and model walls are assumed to be isothermal with a temperature of 500 K. This paper discusses the simulation results and projects recommended parameters.