Paper ID: 12885
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student

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 1 (3A)

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EFFECT OF NOSE CAVITY ON HEAT TRANSFER RATES TO THE SURFACE OF AN AEROSHELL DESCENDING THROUGH THE MARTIAN ATMOSPHERE

Abstract

One of the more important problems in space exploration of Mars is the reentry of the vehicle into the Martian atmosphere. A successful reentry of a hypersonic speed spacecraft will require analytical simulations beforehand for a landing vehicle. A typical Aeroshell for Martian entry with forward facing axisymmetric cavity is investigated numerically for its drag and peak heat transfer rates using commercially available Computational Fluid Dynamics code Ansys Fluent 13.0. The cavities investigated are of circular and hyperbolic in shapes with rounded lips while the lip radius is varied from 10 cm to 100 cm. The Martian entry vehicle chosen for the simulation is 70-deg sphere cone Aeroshell with a diameter of 2.65m. The flow conditions simulated in the investigation are that of ballistic descent through the Martian atmosphere at an altitude of 44.2 km and Mach number of 22. A two dimensional axisymmetric computational fluid dynamic analysis is done for both perfect gas and non equilibrium chemically reacting gas assumptions with non catalytic wall. The Martian atmosphere for this simulation is assumed to be a homogenous mixture of 96