HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)
New Technologies, Processes and Operating Modes Enabling Future Human Missions (7)

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DESIGN, ANALYSIS AND OPTIMIZATION OF A MULTI-PLANETARY ENTRY VEHICLE (MPEV)

Abstract

The effective exploration of the outer reaches of our solar system is one of the most important objectives in the various space programs of the world. For an effective exploration it is very important to have an optimum design which can handle tough and unforeseen environments, aerodynamic challenges, aerothermodynamics challenge, to safely satisfy the mission requirements and to reduce risk and cost. An aerodynamically and aero thermodynamically well designed entry vehicle can also provide crucial information to other key disciplines such as structures, materials, thermal protection etc., Hence the aerodynamics and thermal protection plays a very crucial role in the vehicle design specific to have operational conditions for different planetary missions. The objective of this paper is to design a Multi Planetary entry vehicle (MPEV), which is an entry vehicle capable of entering any kind of planetary environment. It is a single unique design that can handle all 8 planetary environments constituting varying atmospheric temperature, pressure, surface heating, gravity and non-gravity conditions and varying chemical compositions of the atmosphere. Multiple conceptual designs which incorporate certain proven design inclusions such as cavity, aero-spike, geometric eccentricity to name a few are analyzed considering atmospheric conditions of all the 8 planets using computational fluid dynamics tool. Two dimensional analyses is done considering chemically reacting flows pertaining to specific planets. Conclusively this paper provides an optimized entry vehicle design that can enter any planet in the solar system and accomplish the mission successfully without any kind of damage caused due to any planetary condition.