Paper ID: 36754
oral
student

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Science, Instruments and Technologies (3B)

Author: Ms. Lisa Peacocke
Imperial College London, United Kingdom

Dr. Paul Bruce
Imperial College London, United Kingdom
Dr. Matthew Santer
Imperial College London, United Kingdom

DEPLOYABLE AERO-DECELERATOR HEATSHIELD CONFIGURATIONS TO ENABLE HIGH-MASS PAYLOADS AT MARS

Abstract

Current Mars atmospheric entry vehicles are limited to diameters of 4.5 m or less, to fit within existing launch vehicle fairings. A heatshield of this diameter can deliver approximately 1 tonne of useful payload to the Martian surface. Future Mars missions will require significantly larger payloads to be delivered, at higher elevations and with higher precision. A deployable heatshield that extends to its full diameter after launch is an enabling technology for future Mars missions, potentially allowing for tens of tonnes of payload to be delivered to the surface.

Imperial College London and Airbus Defence and Space are collaborating on a research project to design, analyse and test deployable aero-decelerator heatshield configurations for next generation Mars entry vehicles. Current work is focussed on the simulation of atmospheric entry trajectories for such vehicles, mission and requirements analysis to determine the drivers and constraints, and the design and assessment of configuration options. The overall objectives of the research are to determine the lowest mass and most robust design for Mars applications, and advance the technology readiness level by a test campaign in a high-speed wind tunnel.

The six degree-of-freedom simulator development has taken place in Matlab, and incorporates Mars atmospheric data from the European Mars Climate Database. The trajectory simulator includes aerothermodynamic code to determine the aerodynamic coefficients and heating experienced by the entry vehicle, and is coupled with an aerostructural tool to determine the flexure experienced during the atmospheric entry. The entry vehicle configuration options have been developed based on a set of likely Mars mission scenarios, and these are undergoing analysis and optimisation using the simulator.

This presentation will outline the aims of the research project, the entry vehicle configurations under analysis, latest results from the simulator, and preparations for the high-speed wind tunnel test campaign, to take place in 2018.