Paper ID: 33603
oral
student

SYMPOSIUM ON SPACE DEBRIS (A6)
Interactive Presentations (IP)

Author: Mr. Nathan Donaldson
University of Oxford, United Kingdom, nathan.donaldson@eng.ox.ac.uk

Prof. Peter Ireland
University of Oxford, United Kingdom, peter.ireland@eng.ox.ac.uk

STEADY STATE HEAT TRANSFER EXPERIMENTS IN THE SLIP REGIME USING THE OXFORD LOW DENSITY WIND TUNNEL

Abstract

The experimental simulation of planetary entry scenarios has always been a significant technical challenge for space agencies and private industry alike. The ability to simulate the low density, high Mach number flows which are characteristic of atmospheric entry is highly valuable to the design of EDL bodies, hypersonic airliners, and for the validation of rarefied numerical analyses, to name but a few.

The Oxford Low Density Wind Tunnel (LDWT) at the University of Oxford's Osney Thermofluids Laboratory has the ability to produce a vacuum with a pressure of the order of 0.1 Pa with a core flow Mach number inside the test section of up to 6 using its contoured hypersonic nozzle (which is cooled to control boundary layer growth). This paper describes commissioning activities performed for the LDWT following an extensive refurbishment wherein the facility's vapour diffusion pump was serviced and its instrumentation updated to include a full 3D traverse system for wake surveys and variable attitude heat flux experiments, and a large number of low range pressure transducers. Furthermore, the details of the tunnel's ability to simulate steady state heat flux are elaborated upon, and surveys of the plume generated by the hypersonic nozzle are included.

Finally, future improvements to the facility are described, including the recommissioning of the Oxford Magnetic Suspension Balance System (MSBS), a unique electromagnetic suspension device for the stingless assessment of rarefied aerodynamic coefficients.