

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Vehicles – Mechanical/Thermal/Fluidic Systems (7)

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EXPERT – THE ESA EXPERIMENTAL RE-ENTRY VEHICLE: EXPERIMENTS AND PAYLOADS
QUALIFIED AND READY FOR THE FLIGHT

Abstract

During the last years, Europe has dedicated significant efforts to improve the quality and reliability of aerothermodynamic predictions, due to their key importance in the design and development of any hypersonic space vehicle. In fact, the in-flight experimentation is needed in order to validate the computation fluid dynamic tools and to establish meaningful and reliable ground-to-flight extrapolation methodologies. Lessons learned from past European in-flight experimentations, have shown that a well conceived aerothermodynamic in-flight experimentation mission shall be based on a clean and uncontaminated flow, a proper flow free-stream characterization for optimal post-flight analysis and a series of accurate in-flight instruments able to gather high quality in-flight data. In order to satisfy these needs and advance in this research field, the ESA European Space Agency is currently developing the project EXPERT – Experimental re-entry vehicle test-bed. The project EXPERT features a generic simple shape and will perform a sub-orbital ballistic hypersonic flight; with a selection of major shape parameters to avoid any surface active oxidation, degradation and flow contamination. The main objective of the EXPERT project is to collect in-flight data on the most critical ATD phenomena via dedicated classical and advanced flight test measurement assemblies. The following list of EXPERT Payloads perform the selected aerothermodynamic experiments useful to improve the design capabilities with reference to full scale re-entry capsule: -Nose Ceramic CMC Nose cap Assembly -P/L 01 FADS Flush Air Data System -P/L 02 PYREX Nose Heating with pyrometers -P/L 03 PHLUX Catalysis -P/L 04 Natural transition -P/L 05 Roughness induced transition -P/L 06 SWBLI onto Open Flaps -P/L 07 SWBLI ahead of Open Flaps -P/L 08 IR Thermography on rear face of Open flap -P/L 10 RESPECT Shock-layer chemistry by spectrometry -P/L 11 Nose-TPS Step Junction – Temperature jump -P/L 12 Base pressure and base heat-flux -P/L 13 SFS - Skin Friction Sensors -P/L 15 Flying Winglet - Sharp Hot Structure “SHS” -P/L 18 Inter-metallic TPS Flight Experiment The scientific data will then be used to validate state-of-the-art numerical tools for aerothermodynamic applications and ground-to-flight extrapolation procedures aimed to a significant improvements on design tools (including Wind tunnel testing/qualification, CDF multidisciplinary and big improvement on Measurement techniques). In the present paper we present an overview of all experiments and payloads as they have been designed, manufactured, qualified and integrated. Actually the

complete EXPERT vehicle is ready for the flight.