

Technology package on board EXPERT: the European Experimental Re-entry Test Bed (IPPW-7)

F. Ratti*, J. Gavira, A.C. Thirkettle, J. Thoemel

ESA-ESTEC

e-mail: *Francesco.Ratti@esa.int*

ABSTRACT

The European Experimental Re-entry Testbed EXPERT is developed by the European Space Agency ESA as part of its Technological Research Programme. The aim of EXPERT is to improve the understanding of aerothermodynamics phenomena of hypersonic flight. The EXPERT flight opportunity gives the possibility to Scientific Institutions and Industries throughout Europe to propose and perform experiments to obtain aerothermodynamics data for validation of numerical models and for ground to flight extrapolations.

This paper describes the technology on board EXPERT.

The front part of EXPERT consists of a nose of ceramic material developed at DLR Stuttgart. As opposed to previous experimental capsules no ablative material is foreseen. The ceramic nose hosts a set of experiments. The Flush Air Data System FADS developed by HTG aims at collecting free stream parameters for trajectory and vehicle attitude rebuilding. The pyrometer PYREX developed at IRS in Stuttgart collects data on the temperature and heat flux of the ceramic nose. The spectrometer RESPECT developed at IRS aims at resolving the different species generated in the plasma region during re-entry.

The side of the blunted cone are protected by a metallic thermal protection system developed by Dutch Space on which are located several sensors. Two payloads developed by IRS and VKI are dedicated to the measurement of catalytic effects. One aims at detecting the temperature jump between ceramic and metallic surfaces caused by recombination of dissociated molecules reacting with surfaces with different catalytic properties and one with direct measurement of recombination coefficients. Two payloads developed by CIRA and VKI are dedicated respectively to the detection of the natural laminar to turbulent transition and to the roughness induced transition.

In the lower part of the vehicle four flaps are present. A payload developed by CIRA is devoted to the characterization of the interaction between shock wave and boundary layer. Two of the flaps are instrumented by DLR Koln and an IR thermocamera to measure the temperature of the backside of the flap and to characterize the aerothermodynamics effects on the flap is developed by RUAG. A winglet in ceramic material developed by CIRA is also located in the lower part.

On the base of EXPERT pressure and temperature is measured by a payload developed by ALTA. A sample of intermetallic material developed by INASMET is located on the outer part of the base.

The technological payloads have undergone an extensive campaign for the qualification for flight which has been coordinated by ESA technical experts at ESTEC and by CIRA as Payload coordinator.

A relevant and consistent set of experiments compatible with the vehicle resources and allocated budget has been developed and qualified for flight on board EXPERT.

The main industrial partner is Thales Alenia Space in charge of the capsule supporting systems (e.g. data handling, power, DLS) and of the interface with the different experiments.

The experiments on board EXPERT will contribute to a better understanding of aerothermodynamics phenomena. The demanding environment to which the instruments have been qualified allows the re-use of the developed technology for future entry missions.