

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

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THE SHEFEX II THERMAL PROTECTION SYSTEM

Abstract

SHEFEX II is a faceted re-entry body, the purpose of which is to enable low-cost in-flight re-entry research. The faceted thermal protection system consisting of only flat thermal protection panels and sharp leading edges is cost-efficient since it saves dies, manpower and storage. From 2007 to 2010, within a period of three years, the experiment had been designed, laid out, parts have been manufactured, mounted and instrumented for flight. The overall heat shield setup with a thickness of only 30 mm has been qualified for loads up to the order of 1 MW/m². The SHEFEX II payload tip design and manufacturing is presented in the present paper. It gives an overview over the thermal protection system of the SHEFEX II payload forebody including the heat shield material. The paper provides detailed information on the faceted thermal protection including the gap seal, the sharp leading edge, and the aerodynamic control surfaces, i.e. the canards. Central aspect is the transpiration-cooling experiment AKTiV and its infrastructure. Transpiration cooling, as referred to here, is effected by two physical phenomena. One is convection-cooling of the wall material by the coolant as it is fed through the permeable structure. The other one is lowering the heat transfer from the high-enthalpy environment to the vehicle surface by forming a coolant layer or film on the outer – hot – surface. Moreover, the prediction of wall temperature during film- and porous convection cooling will be evaluated with measurement data.