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MINI IRENE PROJECT: GROUND DEMONSTRATOR PLASMA WIND TUNNEL TESTING

Abstract

The Paper describes the Plasma Wind Tunnel activities in the MINI-IRENE FLIGHT EXPERIMENT (MIFE) project, funded by ASI and ESA. MINI-IRENE is the Flight Demonstrator of IRENE: a capsule with a variable geometry, "umbrella-like" deployable heat shield that reduces the capsule ballistic coefficient, leading to acceptable heat fluxes, mechanical loads and final descent velocity. The feasibility study of IRENE was carried out in 2011. The TPS materials were tested at that time in SPES hypersonic wind tunnel at the University of Naples, and in SCIROCCO Plasma Wind Tunnel at CIRA. European Space Agency is now funding the current phase of the program. The aim is to achieve TRL-6, designing and buildilng a Flight Demonstrator and a Ground Demonstrator to prove, with a suborbital flight and with a Plasma Wind Tunnel (PWT) test campaign, the functionality of the deployable heat shield. The

Flight Demonstrator, included as a secondary payload in the interstage adapter of a VSB-30 launcher from ESRANGE, then ejected during the ascent phase of the payload section, will perform a 15-minutes ballistic flight, re-enter the atmosphere and hit the ground. A Ground Demonstrator, representative of the Thermal Protection System of the Flight Demonstrator, successfully passed a test in SCIROCCO Plasma Wind Tunnel at heat flux condition similar to that expected during an atmospheric re-entry from low Earth orbit. The test results for both the flexible TPS and the mechanical elements of the deployable heat shield will be illustrated in this paper together with all the preparatory activities conducted to design the demonstrator and the test.