SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Upper Stages, Space Transfer, Entry and Landing Systems (3)

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AERODYNAMIC PERFORMANCES OF USV3 CIRA RE-ENTRY VEHICLE

Abstract

Since 10 years, CIRA is involved in research activities related to the development of a flying test bed for demonstration of the key technologies for atmospheric re-entry from Low Earth Orbit. Recently, the feasibility study of a challenging vehicle able to perform an end-to-end mission using VEGA, from orbit keeping, through re-entry phases to landing on conventional runway, is carried out in the framework of ASI and JAXA agreement. The aerodynamic plays an important role on the design of such kind of vehicle that has to be able to fly from hypersonic speed to incompressible regime and land safely. The proposed vehicle is the USV3, an unmanned technology demonstrator vehicle capable of re-entry mission. Some of the key technologies that will be demonstrated include composite structures, advanced thermal protection systems (TPS), innovative guidance navigation and control (GNC) strategies and autonomous landing capability. Hypersonic and Supersonic aerodynamics (M¿2) on reference vehicle database was developed in previous studies but, the introduction of new control surfaces and little changes in the shape asked for a review and for an upgrade of these data. Computational Fluid Dynamics and engineering tools have been used to cover this task. Large effort has been dedicated to complete the aerodynamic database with the low supersonic/subsonic data. Also in this case CFD computations and engineering approach have been coupled to obtain more data in relatively short time. Validation of this engineering method is also presented.. An analysis of the longitudinal and lateral-directional stability has been also performed, to obtain all the necessary information for simulations of the re-entry trajectories up to touchdown. Effects of the control surfaces, such ailerons, body flap and rudder, were investigated.