

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

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USV3 PROJECT VISION FOR A SPACE VEHICLE WITH AUTOMATIC RE-ENTRY AND LANDING  
CAPABILITY

**Abstract**

USV3 RE-ENTRY DEMONSTRATOR CONCEPT STUDY

CIRA, the Italian Aerospace Research Centre, in the framework of the national space program and also thanks to international cooperation, has carried out a feasibility study of a future re-entry spacecraft concept with automatic re-entry and landing operational capability. Such vehicle will be injected in a LEO orbit (i.e. 300km) by the Vega launcher to execute few revolutions around the Earth and then perform an automatic re-entry flight. After de-boosting by the VEGA AVUM upper stage the vehicle will execute an autonomous flight from hypersonic to subsonic regimes allowing terminal area energy manoeuvres, approach and landing on conventional runways. A peculiar aspect of this spacecraft is indeed the requirement to land on the conventional runway as a commercial transport aircraft at the Christmas Island airport in the Pacific Ocean. This paper describes the USV3 project scope and context, provides the overview of the mission scenario and outlines the main system-level design results. In the past years CIRA has already completed several steps towards the development of innovative technologies for re-entry flight. Indeed the vehicle concept has its heritage in the national experiences (USV program) as well as in the international participation (ESA EXPERT and IXV, University of Queensland and DSTO SCRAMSPACE). The vehicle configuration, as defined at the present project stage, is a re-entry glider characterized by relatively simple architecture, which embodies all the features of an operational system. The internal layout has been designed to allocate the landing gears, the cargo bay and relevant equipment in the limited volume. In particular, the challenging design of Aerodynamics and Aero-thermodynamics and system optimization were used to promote an innovative vehicle configuration allowing more flexibility in the re-entry trajectories, as compared to typical lifting re-entry vehicle.