

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Technologies for Future Space Transportation Systems (5)

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## RE-ENTRY GNC CONCEPT FOR A REUSABLE ORBITAL PLATFORM (SPACE RIDER)

**Abstract**

An application programme called Space Rider has been proposed to develop an affordable and sustainable reusable European space transportation system to enable routine “access to” and “return from” space, operating in-orbit, de-orbiting, re-entering, landing on ground and being re-launched after limited refurbishment. Space Rider is based on the success of the Intermediate eXperimental Vehicle (IXV), an ESA re-entry lifting body demonstrator built to verify in-flight the performance of critical re-entry technologies needed for the return from Low Earth Orbit (LEO) and for Exploration. The IXV successfully flew on February the 11th, 2015 and demonstrated key technologies like Thermal Protection System (TPS) and Guidance, Navigation and Control system (GNC). Space Rider will perform in-orbit operation, experimentation and demonstration for applications like micro-gravity experimentation, orbit applications and In-Orbit Demonstration and validation of technologies. These technologies suitable for demonstration inside Space Rider cover a wide spectrum: from Earth science to planetary Exploration. The re-entry module itself is a test bed for entry technologies as the IXV precursor was. The project is currently running Phase B2. The re-entry module will be based on the IXV shape and shall be able to flight at least 5 times after refurbishment. During the atmospheric entry the same GNC as in IXV will be used, tailored to the specific mission needs. The main differences come from the extension of the flight to cross the transonics in order to deploy the parachute in subsonics and the pinpoint landing, which is achieved with a guided parafoil to steer the vehicle towards the landing aerodrome with an accuracy better than 150 m. In addition, the operational and reusable nature of the vehicle requires fault tolerance management at GNC level. The paper discusses the re-entry module GNC requirements, challenges and achievements. The operational concept is presented as well as the functional, operational (modes) and physical (sensors and actuators) architecture. This work has been carried out in the frame of the Space Rider programme of the European Space Agency with Thales Alenia Space Italia and ELV as Prime contractors. In this context, SENNER is the lead contractor for the Reentry Module GNC.