IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
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GROUND SEGMENT, LANDING SITE AND OPERATIONS OF SPACE RIDER: EUROPE'S FIRST REUSABLE SPACE TRANSPORTATION SYSTEM

Abstract

Space Rider will provide Europe with an affordable, autonomous, reusable end-to-end integrated space transportation system, facilitating routine access and return from space. As such, its Ground Segment, Landing Site, and Operations are presently being developed and qualified to fulfil the challenging system requirements, emphasizing on maximizing reusability for a cost-effective approach.

The two Vehicle Control Centres, geographically separated and with distributed responsibilities regarding early-orbit, in-orbit, re-entry, landing and Ground Station Network operations, were indeed designed leveraging on the reuse of existing facilities, tools, expertise and lessons learned coming from ESA IXV re-entry mission, complementing in orbit control with landing operations, a first in Europe. Moreover, the Payload Ground Control Centre will coordinate and plan customer's operations and standard interfaces for various users, configurable for each mission. The Control Centre's architecture is designed to be scalable and adaptable, ensuring consistency across all future missions of the reusable vehicle.

Space Rider mission operations are complex and encompass various elements, to guarantee mission: continuous payload needs fulfilment, trough real-time monitoring of critical phases, downlink requirements, collision avoidance maneuvers, and re-entry and landing procedures. Specifically, the Landing Function of the Mission Control Centre is tailored to accommodate different Landing Sites in its core functions. These sites will adhere to standardized tools and processes, guaranteeing functional and operational compliance with the demanding requirements for vehicle re-entry to Earth. The Landing Site is conceived with a minimum lifetime duration aligned with the flight system's lifecycle, optimizing the reuse of existing infrastructure and systems. This reusability approach allows to significantly decrease the number of tests needed for new infrastructure, tools and network, while ensuring streamlined operations; furthermore, this approach ensures a more sustainable development of ground segment and landing site infrastructures.

The paper provides an in-depth overview of the Ground Segment, Landing Site, in-orbit, re-entry and Landing Operations of the first European reusable re-entry vehicle, offering insights into their robust architecture and challenging operations, all while emphasizing the commitment to leverage on existing systems and fostering ground system sustainable development, in full synergy with the overall sustainable concept of the Space Rider vehicle