SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Poster session (2D)

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ANALYSIS, TEST AND SIMULATION OF LANDING SYSTEM TOUCHDOWN DYNAMICS

Abstract

Future exploration missions pose demanding requirements towards the access by vehicles to scientifically interesting sites on planetary surfaces. These stem particularly from the need of more flexibility in site selection, improved payload to vehicle mass ratios and higher mission success probabilities. The Landing Technology group of the DLR Institute of Space Systems is focusing on the development and verification of experimental and analytical methods for the investigation of the touchdown dynamics of landing systems. Core element for the experimental investigation is the Landing Mobility Test Facility (LAMA), which allows touchdown testing under Earth gravity and under a reduced gravitational environment using an active off-loading device. The test article for investigation of legged landing systems is a modular Lander Engineering Model (LEM) designed by the Astrium GmbH (Bremen), representing European mission scenarios to Moon and Mars such as the ESA Lunar Lander, ESA Mars Precision Lander or the ESA Phootprint landing system. Another test object recently under retesting is the Rosetta lander Philae representing a touch down system concept developed for small body landings. As not all relevant environmental properties of the target landing site can be provided in one single and complete test, any verification approach has to be supported by adequate numerical analyses. Thus the experimental investigation of a landing system is complemented by high fidelity engineering simulations of the landing platform, its touchdown conditions and the landing site. This poster outlines the test facility, simulation and analysis tools developed by the working group and used in recent landing missions.