SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 3 (2C)

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AUTONOMOUS PLANETARY LANDING GNC AND HAZARD AVOIDANCE, PERFORMANCE TESTING BY MEANS OF TERRESTRIAL FIELD TESTS

Abstract

In order to prepare future international planetary exploration scenarios aiming for large and potentially manned outposts on solar system bodies, Germany has, in the past years, defined a roadmap for the realization of an unmanned precursor mission to the Moon.

This precursor mission, currently planned and prepared by the European Space Agency, is envisaged to be flown before the end of this decade and shall, besides a science oriented mission goal, help to develop and demonstrate key technologies for the autonomous soft precision landing also applicable to planetary exploration of other hard surfaced solar system bodies.

These technologies encompass descent engine propulsion by means of a cluster of non throttleable engines, visual navigation and hazard avoidance by means of CCD camera and Lidar, landing system dynamics and stability, and autonomous GNC, mission and vehicle management software.

In view of this ambitious time frame, the German Space Agency (DLR) has started a terrestrial lander demonstrator project in 2009, which shall raise the technology readiness of these key technologies as well as setting up a test program for their practical demonstration, finally on board a free flying platform to be dropped from a helicopter.

This terrestrial Lander Demonstrator shall perform a fully autonomous soft precision landing including active hazard avoidance. The engine propelled flight time of the free flying lander will be about 90 seconds, allowing the end-to-end demonstration from altitudes up to about 1200 meters, including landing site identification, terrain relative navigation, the risk mapping of the reachable landing area, trajectory replanning for hazard avoidance, and soft landing.

The paper will give an overview of the drop test mission, the GNC and Hazard Avoidance concept envisaged for this demonstrator, and the activities and goals of the corresponding technology development program. The paper will also explain the significance of terrestrial landing system demonstrations for the progression in lander technology development and explain how the results obtained from these demonstrations, although obtained in a different gravity and atmospheric environment, can be applied to the ultimate planetary landing mission.