

SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (4)

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PHILAE LANDING TEST AT THE LANDING AND MOBILITY TEST FACILITY (LAMA)

Abstract

In the recent decades the number of spacecraft visiting asteroids and comets has risen. But only a few of them have swung into an orbit of these small bodies and even only two had physical contact to the surface. The ESA mission Rosetta is on the way to meet the comet 67P/Churyumov-Gerasimenko in May 2014. Once in orbit the spacecraft will release the small lander Philae which is supposed to land softly on the cometary surface, anchor itself to the ground with harpoons and perform its scientific observations. This will be the first time in history a lander will touch down on a comet nucleus. The greatest challenges of the landing manoeuvre are the unknown surface properties and the fact that the original target comet 46P/Wirtanen had to be changed into a much larger comet with higher mass. Especially the second fact is a critical point, because the higher mass of the comet leads to a higher landing velocity and therefore a higher kinetic energy which has to be absorbed. This effect could not be compensated by a design change, because it was too late to change the design significantly, since the lander was ready at launch site at that time. For this reason a new test campaign, led by a consortium of DLR Institutes and the Max-Planck-Institute of Solar Research in 2012/2013, has been set up at a facility where further touchdown conditions could be tested which have been out of capability of the pendulum test facility used for the original qualification of Philae. A pendulum test facility is separating the Earth-weight from the forces of inertia by letting the test object swing against a vertical wall. However a limitation of this concept is a severely constrained motion of the test object and the inability to touch down on loose granular material. These disadvantages have been overcome by using an active weight-offloading device which is provided for the recent new tests by DLR's Landing & Mobility Test Facility (LAMA). This paper gives an overview of the performed work, recalls briefly the Philae landing system and introduces the test facility concepts with its operation modes. The effects of the different facility concepts are highlighted using test data from both test campaigns. The paper also presents and discusses the preliminary results from this recent campaign and gives an outlook to its further use in the upcoming landing preparations.