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SAMPLING SYSTEMS FOR LOW GRAVITY BODIES

Abstract

Low gravity bodies present peculiar conditions which need be taken into account during the design and test of sampling and sample handling systems. The major effect comes from the very reduced gravity which has two major impacts areas: drill, sampling and sample handling process and surface/subsurface soil formation and characteristics.

In general no or reduced gravity will limit the thrust reaction capability in support to drilling operations; indeed reactions can be achieved by spacecraft anchoring or by thrust reversal. In any case operational limitations will be present. Forces naturally arising from Spacecraft momentum inversion can be exploited in fast sampling operations and can be achieved by 'touch and go' techniques (as e.g. performed in Hayabusa mission). Fast sampling can also be achieved by 'libration and go' trajectories (like in Osiris Rex). Fast sampling performance may be limited in terms of sampling depth and collectable soil types.

Marco Polo mission and Phobos mission represent other scenarios for low gravity. Other bodies of reduced gravity are constituted by comets. In this respect Rosetta lander is a remarkable example to become operative (in situ) end 2014 after eleven year cruise phase. Rosetta is equipped by a drill and distribution system (SD2) designed and developed by a team led by Selex ES. SD2 is capable to sample at depth from surface down to 0.2 m and distribute the collected samples to the scientific instruments.

Another important point is the transportation/handling of the sample; the absence (or almost) of gravity render this process uncertain. Sample containment or forced volumetric actions are advisable. Sparse sample could be immediately contained and the container/vessel transferred.

The proposed paper will cover some of the above recalled important thematics associated to sampling in presence of low gravity conditions and the characteristics of sampling H/W developed for reduced gravity applications will be presented.