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SCIENCE AND PAYLOAD ACTIVITIES IN SUPPORT OF THE ESA LUNAR LANDER

Abstract

Introduction: ESA's Human Space Flight and Operations directorate is continuing with preparations for its Lunar Lander project. The Lunar Lander is an unmanned precursor mission to future human exploration, whose purpose is to drive the development of key technologies and generate scientific knowledge that will position Europe as a participant in future exploration of the Moon and beyond.

Scientific topics for investigation: The scientific topics that have been defined for the mission emphasise areas of importance for the future of exploration. These include the integrated dusty plasma environment and its effects on systems; lunar dust as a potential hazard; potential resources; and radiation.

Model payload: In order to address these scientific topics and meet the associated requirements a model payload has been defined. This model payload is used to inform the mission study in advance of a formal selection in order to ensure that challenges associated with accommodating candidate experiments are properly accounted for. Payloads currently under study are described below.

The Lunar Dust Analysis Package (L-DAP) is an instrument package to determine the microscopic properties of lunar dust including the size distribution for particles from tens nm – 100s m, the shape and structure of grains, chemical and mineralogical composition of particles.

The Lunar Dust Environment and Plasma Package (L-DEPP) is a package to determine the charging, levitation and transport properties of lunar dust, in-situ on the Moon, and the associated properties of the local plasma environment and electric fields. Measurements include the charges on levitating lunar dust particles, the velocities for levitating lunar dust particles, the trajectory of levitated dust particles, the temperature and density of the local plasma, electric surface potential, observations of the radio spectrum (with an additional goal to prepare for future radiation astronomy activities).

The Lunar Volatile Resource Analysis Package (L-VRAP) is a package to measure the species of volatiles present close to the lunar surface, their abundance and distribution and demonstrate their extraction. The primary mechanism for performing such an analysis is expected to be mass spectroscopy, although additional complimentary measurements may be considered. The potential effects of contamination by the Lander may be critical and so quantifying the likely contamination and its effects are also being investigated.

Additional payloads under consideration for the mission include cameras and a radiation monitor.