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Science goals of MoonNEXT, an ESA study to put a lander on the Moon

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MoonNEXT is a Phase-A study performed under the direction of the European Space Agency to study a lander and a rover on the Moon. The mission would be launched between ExoMars (scheduled for a launch in 2013) and the Mars Sample Return (MSR) mission, envisaged for 2020. MoonNEXT is a study performed in parallel with a study for a network science mission to Mars, called MarsNEXT.

The mission shall demonstrate soft precision landing and autonomous hazard avoidance technologies required for MSR and other future exploration missions. It shall also prepare for future lunar exploration activities by characterizing the lunar surface environment, performing relevant life science investigations and testing technologies key for exploration. It will advance our understanding of the origin, structure and evolution of the Moon by performing a range of geophysical and geochemical investigations, and assess the value of the lunar surface as a future site for performing science from the Moon, using radio astronomy as an example.

The scientific objectives are:

- To study the geophysics of the Moon. In particular, the mission will focus on

understanding the origin, differentiation, internal structure and early geological evolution of the Moon.

- To obtain in-situ geochemical data from the lunar south pole area, within the Aitken Basin. The Aitken Basin is of special interest as here it is expected to find lower crustal and possibly upper mantle material.
- To study the environment at the lunar south pole, in particular to measure the radiation environment, the dust flux, both coming from impact ejecta and direct micrometeoroid flux, and a possible magnetic field.
- To study the effect of the lunar environment on biological systems.
- To further our understanding of the ULF/VLF background radiation of the universe.

The mission will consist of a lander and a rover. About 100 kg of mass are available for the payload including the mass of the rover itself and any deployment devices needed for the instruments. Currently, the envisaged payload on the lander ('static payload') consists of a small camera to monitor the deployment of the rover, a radio antenna (dipole), a life-science experiment to expose micro-organisms to the lunar environment, and a dust monitor, a radiation monitor, a magnetometer, a mole to measure the heat flux and the soil density, and a very broad-band seismometer.

The rover will be used to deploy three autonomous short-period seismometer boxes, spaced several kilometres apart on the lunar surface. These stations will be completely autonomous and communicate with the lander. The rover will also have a panoramic stereo camera with different spectral filters; a high-resolution camera; a spectrometer (UV, VIS-NIR, MIR) and a Raman/LIBS (Laser-Induced Breakdown Spectroscopy) instrument to determine the atomic and mineralogic composition of different rocks; and a second radio antenna to perform interferometric measurements together with the antenna on the static payload.

All instruments will share a common electronics box, with 'Eurocard'-sized printed circuit boards for the back-end electronics.