THE MOONNEXT MISSION: A EUROPEAN LANDER AT THE LUNAR SOUTH POLE. J. D. Carpenter[1], B. Houdou[1], D. Koschny[1], I. Crawford[2], H. Falcke[3], S. Kempf[4], P. Lognonne[5], C. Ricci[6] and A. Pradier[1], [1] ESA ESTEC, Keplerlaan 1, Noordwijk, Netherlands, James.Carpenter@esa.int, [2] School of Earth Sciences, Birkbeck College, London, UK,.[3] Department of Astrophysics, Faculty of Science, Radboud University, Nijmegen, Netherlands, [4] MPI für Kernphysik, Heidelberg, Germany, [5] IPGP, Paris, France, [6] Univ. Milan, Milan, Italy.

Introduction: ESA's Aurora Exploration Programme recognizes the key role of the Moon in the path of exploration and is currently leading several feasibility studies of a Lunar Lander mission, also called "MoonNEXT". This mission, expected to be to be launched from Kourou with a Soyuz in the 2015-2018 timeframe, combines technology, exploration and science objectives, consistent with the broader context of international lunar exploration. The nominal landing site for MoonNEXT is edge of the South Pole Aitken basin (SPA).

Technology Objective: The main technological objective of MoonNEXT is to perform an autonomous soft precision landing with hazard avoidance at a well illuminated site near to the Moon's South Pole. This autonomous approach to landing will complement that of the ExoMars mission, while validating a key technology for more ambitious exploration missions, enabling landing on rough and unpredictable terrain, targeting special areas of interest and surface rendezvous. The closed-loop use of new-generation terrain-relative sensors for navigation and hazard detection will be required. The mission builds on a significant technology development effort ongoing in Europe in the area of Guidance, Navigation and Control.

Braking will be performed entirely by propulsive means, thus paving the way towards the capability to land increased masses on low gravity bodies.

Exploration and Science Objectives: In addition to enhanced landing technology, MoonNEXT includes instrumentation to address major objectives related to preparation for future human exploration activities and unresolved scientific questions.

Geophysics. MoonNEXT will make seismic measurements from the South Pole of the Moon. These data can be combined with those from Apollo to determine the size and state (and thus likely composition) of the Lunar core and indicate whether the seismic discontinuity at ~500 km [1] depth is Moon wide. Realising the global, or otherwise, nature of this phenomenon is essential to constrain the magma ocean / magmasphere model of the Moon (e.g. [2]). Determinning the level of seismic acivity is also important for the development of future human habitats.

Measurements of heat flow at depths of several meters into the regolith, will improve our understanding of the Moon's internal temperature distribution by providing a data set from a location very different from the Apollo missions [3], which were not representative of the Moon as a whole.

Environment. The radiation, dust and meteoroid environment on the Moon will also be investigated. Of particular importance are the factors which drive the charging, levitation and transport of lunar dust [5], identified as a potential hazard for the surface operations of future human missions. During the Apollo mission lunar dust was found to be abrasive, adhesive and problematic following migration into habitats [5].

The flux of micrometeoroids will be investigated, with emphasis on micrometeoroids in the size range of ~10 mg, for which fluxes are highly uncertain and which have been identified as posing the greatest potential risk to human activities.

A proper characterization of the radiation environment, resulting form both cosmic and highy variable solar sources will also be characterized, to determine potential risks to human activities.

Geology and Geochemistry. SPA offers the unique possibility to sample material, which has been excavated from the lower crust and perhaps even the upper mantle offering unique insight into the Moon's history and evolution [6]. In addition the regolith at the South Pole may contain volatiles, deposited by the solar wind.

Life Sciences. MoonNEXT will include an experiment coupling two microorganism cultures in a closed loop ecosystem. By monitoring the evolution of the system the effect of the lunar environment on living cells' behaviour will be investigated, as well as technical concepts pertaining to future life support systems.

Radio Science and Astronomy. The Moon provides a superb location for radio astronomy because it provides access to radio frequencies inaccessible from the Earth [7]. MoonNEXT will demonstrate the feasibility of radio astronomy on the Moon by characterising the radio environment.

References:

[1] Warren, P.H.(1985) Ann. Rev.Planet. Sci., 13, 201-240. [2] Goins, N.R. et al. (1981) JGR, 86, 5061-5074. [3] Langseth et al., (1976) Proc. Lunar Sci. Conf. 7, 3143-3171. [5] Stubbs, T.J. et al., (2007) Proc. 'Dust in Planetary Systems', ESA SP-643, 239-241. [5] Pieters, J.W. et al., (2001) *JGR, 106,* 18001-28022 [6] Carilli, C.L. et al., (2007) arXiv :astroph/0702070v1.