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MiniPINS - Miniature Planetary In-situ Sensors

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MiniPINS (Miniature Planetary IN-situ Sensors) is an ESA study led by the Finnish Meteorological Institute to develop and prototype miniaturised surface sensor packages for Mars and the Moon. The study aims at miniaturising the scientific sensors and subsystems, as well as identifying and utilizing commonalities of the packages, allowing to optimise the design, cut costs and reduce the development time. This presentation includes the main results from Phase A study and Preliminary Requirements Review of MiniPINS.

Mars In-Situ Sensors (MINS) is a concept based on the strong heritage of the MetNet lander. MINS mission consists of 4 scientific observation posts on the Martian surface, about 25 kg each. The MINS landers will travel to Mars aboard the carrier spacecraft provided by another mission. Several concepts for MINS penetrators were studied in Phase 0, and finally 2 concepts were chosen for the final selection. The concept selection was driven by the target penetration depth, as this parameter is deeply influenced by the penetrator design.

The MINS concept of 0.5 m penetration depth was selected by means of a trade-off. The selected concept is a rigid probe concept, similar to MetNet penetrator. Its development level is quite high, and its scope is compatible with MINS mission. This concept is limited from the scientific point of view, as it does not allow to penetrate so far in Martian subsoil; but its more advantageous from the criticality point of view as it has a higher development level and is less complex. The concept allows to perform majority of the scientific measurements, as all science goals except the heat flow measurement, can be accomplished also in shallow depth.

Lunar In-Situ Sensors (LINS) is a new concept of a scientific mission package to investigate the Lunar surface and environment. LINS missions consist of 4 surface stations, 7 kg each, deployed on the Moon by a rover. In the case of LINS thermal and power design are the major drivers of the LINS architecture definition because of the Moon extreme environment, owed in part to the long lunar night period. The most relevant decision with regard to the LINS package is whether to include a RHU or not. In the absence of an RHU, the thermal and power subsystems become strongly compromised. Incorporation of an RHU offers many advantages. Consequently, the incorporation of the RHU is the selected concept for LINS.

The two main concepts for mechanical structure of the LINS were evaluated: monocoque structure with legs and double structure without legs. A design concept was chosen that consists of a double structure, so that there is an internal and an external one. The external one acts as an exoskeleton for the internal and is separated from it by blocks. The separation between the two structures provides some space to accommodate additional thermal insulation if necessary.

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