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Ma.R.E.-Dos.E.: Mars Radioactivity Experiment and DOSimeter Experiment

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The future human exploration of Mars can take place if the environment the astronauts will encounter is well characterised, and the risks understood and quantified. Ma.R.E.-Dos.E. is an experiment designed to perform the monitoring of the Mars radiation environment during cruise and landing sites.

The radiation dose rate to which crews will be exposed is one of the hazard that has to be quantified before the human exploration of Mars may begin. Data for evaluating radioactivity levels at Martian surface are of great interest for environmental studies related to life in general. Because evidences for past climate changes and ancient life, if any, are most likely embedded in soils and rocks, it will be very important to perform measurements of radioactivity, to monitor the background of the soil/rock and induced radioactivity by interaction with cosmic rays. The proposed dosimeter is passive one and will be able to measure the b and g radiation dose received by the probe in the range 30-300 KeV, with a responsivity which is very close to that of a living organism (Bos, 2001).

This experiment in part complementary with MARIE, payload on the 2001 Mars Odyssey Orbiter (Zeitlin et al., 2004), studies Mars radiation environment during cruise and landing sites instead of from orbiter.

Dose passive experiment is based on doped thermoluminescence lithium-fluoride passive detectors (TLD). The capacity of these detectors to integrate the received energy from their last reset, would be adequately used to measure the possible collected doses during different phases of the mission: cruise phases, permanence on Mars. The measure process is based on the photon counting of luminescence radiation emitted during

the detectors heating cycle. The doped pills are basically constituted by lithiumfluoride (LiF:Mg,Cu,P) which can be exposed to the radiation, reset and read out by heating to a temperature of about 250˚C.

Dose is a package that has been selected by Agenzia Spaziale Italiana (ASI) in the frame of the NASA Mars Surveyor program. It is worthwhile to note that the passive sensor even thought is not able to provide an instantaneous measurement of the dose rate, it is conversely able to return a total dose measurement very close to that a human tissue could accumulate during any phase of the mission with no power request to the system, being completely passive operated. It is to be noted however that TLD cannot measure the heavy component, but as recent works of Cucinotta et al. 2004 and Saganti et al. 2004 have shown on the total accumulated dose the heavy component results to be a negligible part.

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