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On the control of magnetic perturbing field onboard landers: the Magnetometer Protection program for the ESA ExoMars/Humboldt MSMO magnetometer experiment

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Magnetic field observations at a planetary surface have a wide potential of scientific applications, ranging from processes in the dynamic interaction between the planet environment and the solar wind, to determining the structure and thermal evolution of the interior of the planet as well as characterizing its sub-surface. Magnetic fields are generated by electric currents in the planetary space environment, induced currents in the planetary interior and possibly remanent magnetism. In consequence, hardly any other single physical quantity can be used in such a variety of studies related to planetary research.

The major difficulty in implementing a magnetometer experiment onboard a lander is to achieve at acceptable costs a good Magnetometer Protection, namely to control the perturbing magnetic field generated by the lander during operations at the planetary surface, so as to achieve the least magnetic contamination of the magnetometer data by lander generated magnetic perturbations, and thus the best possible magnetic signal to magnetic noise ratio, thus ensuring the best possible magnetometer experiment science return.

The purpose of this talk is to show that simple and non-expensive solutions enable one to limit the intensity of lander generated perturbing magnetic fields to levels that are compliant with the science based measurement requirements. The presented solutions are based upon ‘best effort’ to being critically concerned with magnetic noise reduction, with emphasis on good and simple engineering techniques enabling minimization of and control over the magnetic perturbations at the magnetometer sensor during the surface operations phase.

The presentation deals with the case history of the ongoing preparation of the MSMO magnetometer experiment, which is part the Humboldt scientific payload in the frame of the ESA ExoMars mission. Experience from previous missions constitutes the background for the MSMO Magnetometer Protection strategy. DC and AC lander generated magnetic perturbations are discussed, with particular attention to those related to solar generators. Emphasis is put upon the fact that awareness of magnetic issues and a realistic sense of proportions applied early in the design phase, definitely leads to a better end result than postponing the issues to a later phase, where the design has already been frozen and changes are difficult or impossible to implement and very resource consuming.