

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 3 (3C)

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EXOMARS DRILL EQM INTEGRATION AND PRELIMINARY QUALIFICATION CAMPAIGN

Abstract

The ExoMars mission foresees, in its operational scenario on Mars, the acquisition and on board processing of soil samples taken at depths down to 2 meters. Once extracted the sample is transferred to the Rover on-board scientific instrumentation for analysis. The key element for the acquisition of the samples is the ExoMars Drill, based on a multi-rod concept.

After successful completion of a breadboarding and test phase on the key components and assemblies (Drill tools, extension rods, rod's magazine, positioner, up to the whole Drill unit), a new model, named Drill pre-EQM, more representative of the final flight design, has been integrated. Such model includes both parts that are already at qualification level (namely the structure and the mechanics) and parts at commercial level that later on will be upgraded to EQM level (e.g. the actuators).

Meanwhile, an engineering model of the complete control electronics has also been integrated, and the first version of the control software (flight version) has been released. The pre-EQM interfaced with the EM control electronics will be subject to a thorough test campaign in the forthcoming months. This campaign will include sample acquisition of Mars-analogue material in laboratory and in Mars-like conditions, with the double objective of getting confirmation of the key drilling parameters (such as needed resources in terms of power and thrust, advancing speed, amount of collected material, etc.) and of verifying the operability and timelines of the integrated Drill HW - Control Electronics - Flight Software. Tests will be conducted on the enlarged variety of soil materials already used to characterize the design in last phase.

To support the environmental test campaign, a dedicated facility has been designed and built in order to reproduce Mars-Like conditions in terms of temperatures, atmospheric composition and pressure. Such unique facility has been realized in order to allow complete drilling and sampling operations down to two meters depth.

The paper will present the key characteristics of the developed Drill pre-EQM, the main aspects of the EM Electronics and the performance of the integrated system. Also the special test facility for Mars

environmental testing will be described. Depending on the actual schedule of the test campaign, some of the test results will be presented.