

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

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TESTING THE EXOMARS DRILL IN MARS-LIKE CONDITIONS

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 upon a multi-rod concept.

At the present time, a preliminary Engineering Qualification Model (pre-EQM) of the Drill has been manufactured and integrated. Such a model includes both parts that are already at qualification level (namely the structure and the mechanics) and parts at commercial level that will be upgraded to EQM level later on (e.g. the actuators).

The Drill pre-EQM, commanded by the Engineering Model of the Drill Control Unit (electronics and software), is currently undergoing a thorough test campaign. At the time this abstract has been written, two “vertical survey” to 2m depth have been completed in laboratory conditions, while a test campaign in Mars-Like conditions is about to start.

The “vertical survey”, one of the mission objectives of the ExoMars Drill, consists in drilling the soil down to a depth of two meters while collecting samples of the soil/regolith every 50cm, namely at 0m, 0.5m, 1m, 1.5m and 2m depth. As stated above, an intense test campaign in laboratory conditions has been carried out completing two vertical surveys in suitable stratigraphies composed of a variety of Mars-analogue materials. Ten samples have been collected throughout this test and the two meters depth has been reached twice. Results of this campaign will be presented in the final paper and during the presentation.

In these days (February 2013), a very important step forward is planned for the ExoMars Drill: to perform deep drilling and sampling (down to 2m depth) in Mars-Like conditions. This environmental test campaign will be executed utilizing a dedicated facility designed and built at CISAS (University of

Padova) in order to reproduce Mars-Like conditions in terms of temperatures, atmospheric composition and pressure. The facility is also able to host a dedicated sample container, filled with Mars-analogue rocks and regolith/sands, capable to reproduce the temperatures of the Mars soil itself. The paper will present the main steps and the results obtained in this important test campaign that, upon completion, will achieve a TRL 6 for the ExoMars Drill.