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FLIGHT-MODEL TEST RESULTS OF THE SAMPLE HANDLING SYSTEM IN THE EXOMARS ROSALIND FRANKLIN ROVER

Abstract

Sample handling on Mars imposes unique and stringent requirements on mechanism design calling for special solutions that cope not only with the challenging space environments upon arrival on Mars but also with the presence of dust and varying subsoil material in Martian environment. The paper presents the design and testing of the Sample Preparation and Distribution System (SPDS) which has been developed by OHB System AG as equipment of the Analytical Laboratory Drawer on board the ExoMars Rosalind Franklin Rover. The ExoMars Rover and Surface Platform Mission, planned for launch in 2022, is a large international cooperation between the European Space Agency and Roscosmos with a scientific contribution from NASA. Thales Alenia Space is Prime Contractor to ESA.

The SPDS equipment is formed by a mechanism chain consisting of four different subunits to handle Martian subsoil samples provided by the rover-mounted drill. They convey the material into an environment, which is protected from earth-borne contamination, and perform the sample crushing, dosing and distribution to the instrument payloads for scientific analysis. OHB is in charge of the entire mechanical detailed design and the equipment-level testing.

The first part of the paper provides a short discussion about the different design drivers imposed by the sample handling on Mars and the stringent cleanliness and planetary protection requirements originating from the high sensitivity of the instruments required to find traces of past and present life on Mars. This is followed by an overview of the design and features of each subunit to comply with the different competing requirements. Furthermore the functionality along with the intended interaction and sample transfer between each subunit is described.

The main part of the paper presents the results obtained by the flight-model testing of each subunit standalone as well as some major outcomes of the qualification test campaign that, besides environmental testing, also contains a large number of sample tests. At the writing of this abstract all flight models are successfully integrated and tested in the Rover flight model awaiting the launch in 2022.