48. INTERNATIONAL DETERGENCY CONFERENCE (IDC) in Düsseldorf;

4.4.-6.4.2017

Microbial bioburden determination in frame of “Planetary Protection” activities

Kristina Beblo-Vranesevic[1], Petra Rettberg[1]

[1]German Aerospace Center e.V. (DLR), Institute of Aerospace Medicine, Radiation Biology Department , Cologne

Planetary protection is the term that describes the aim of protecting solar system bodies (i.e. planets, moons, comets, and asteroids) from contamination by terrestrial life, and retroactive protecting Earth from possible life forms that may be returned from other solar system bodies. Based on the Outer Space Treaty, the Committee On Space Research (COSPAR) has established a planetary protection policy and guidelines that also the ExoMars Mission adheres to. The implementation of planetary protection requirements for ExoMars comprise restrictions on impact probabilities for flight hardware not intended to directly contact Mars, and biological and organic contamination control for all spacecraft elements. Specifically parts of the spacecraft that come into contact with the samples from Mars have to be sterile and clean to avoid compromising the life-detection experiments.
The quantification of bioburden, i.e. the microbial contamination on spacecraft and in spacecraft assembly facilities, is based on a classical cultivation method. This method gives only an indication of the real bioburden, because only those microorganisms can be counted that are able to grow under the selected conditions that are heat-tolerant, viable, cultivable, aerobic as well as anaerobic, and heterotrophic spores or vegetative bacteria. It is not possible to detect non-heat tolerant, non-viable, non-cultivable, vegetative cells or those that grow under various different conditions (e.g. T, pH, different nutrients, ± O_2) and no species identification is made by this assay. The majority of the naturally occurring microbial population, which is up to 99 % in many habitats, cannot be cultivated and is therefore not detected by the above mentioned or comparable methods. The biodiversity, i.e. the number of microbial species in a specified habitat, here on spacecraft and in spacecraft assembly facilities, and also their relative abundance, is measured by cultivation methods using a variety of different media and culture conditions and, in addition, by non-culture-based methods for the molecular analysis of non-cultivable microorganisms.