

EXPOSE-R2, the 3rd EXPOSE Mission

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Introduction: The International Space Station ISS provides a variety of external research platforms for experiments aiming at the utilization of space parameters like vacuum, temperature oscillation, extraterrestrial UV and ionizing radiation, i.e. an ideal environment for astrobiological experiments. These platforms and their specific environment are of special interest for astrobiological exposure experiments.

The ESA facilities called “EXPOSE” are designed to accommodate a variety of astrobiological experiments for long term exposure on the ISS external platforms. The facility is optimized to allow exposure of biological specimen and material samples under a variety of conditions, using optical filter systems. Environmental parameters like temperature and radiation are regularly recorded and down linked by telemetry.

Two EXPOSE missions were already performed successfully: EXPOSE-E on EuTEF on one external balcony of the European Columbus Module and EXPOSE-R on the external URM-D platform of the Russian Zvezda Module.

The Mission: On the same platform, the third EXPOSE mission called EXPOSE-R2 is currently flying on the ISS for an expected exposure duration of 16 months. EXPOSE-R2 was launched from Baikonur on 56P on July 23rd, 2014. Two Cosmonauts fastened the facility outside on the Zvezda Module during EVA-39 on August 18th, 2014. The facility was commissioned and evacuated, but remained switched off and closed with respect to UV until EVA-40 on October 22nd, 2014, when the cover was removed and the facility switched on again.

Data are continuously retrieved from EXPOSE-R2 and fed into a mission parallel Mission Ground Reference Experiment performed at DLR, Cologne.

A third EVA for EXPOSE-R2, currently planned for February 2016, will bring back the facility into the ISS. Download of the 3 trays for sample return and analysis and marking the end of the mission is foreseen until May of 2016.

As before, a variety of chemical, biological and dosimetric samples are exposed to the harsh space environment to increase our knowledge on the origin, evolution and distribution of life, on Earth and possibly beyond. The biological experiments investigate resistance and adaptation of organisms like bacteria, *Achaea*, fungi, lichens, plant seeds and small animals like mosquito larvae, exposed in different biological organization forms like e.g. biofilms or communities. The organic chemical experiments analyze chemical reactions triggered by the extraterrestrial environment, especially short wavelength UV radiation, to better understand prebiotic chemistry. Dosimetric samples will support the analysis of the radiation and UV environment.

The preparation of the mission and the mission itself up to now is presented with special focus on the astrobiological experiment BOSS – Biofilm Organisms Surfing Space - on EXPOSE-R2, the experiment contributed by the Astrobiology group of the Radiation Biology Department, Institute of Aerospace Medicine at DLR Cologne, and discussed.

From EXPOSE-E and EXPOSE-R, two special issues on the outcome of the experiments are available in Astrobiology (EXPOSE-E, [1]) and in the International Journal of Astrobiology (EXPOSE-R [2]).

References: [1] Special collection on EXPOSE-E mission (2012) *Astrobiology* 12(5), Ed.: Sherry L. Cadby, Mary Ann Liebert, inc. ISSN: 1531-1074. [2] Special Issue: EXPOSE-R (2015) *International Journal of Astrobiology* 14 (1), Ed: Rocco Mancinelli, Cambridge University Press, ISSN: 1473-5504