

## **Extermophylic microorganisms: issue of interplanetary transfer on external spacecraft surfaces.**

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Interplanetary transfer of terrestrial microbes, capable of surviving in extreme environments and planetary protection from accidental biocontamination by them are the issues of major practical rather than hypothetical value.

The natural resistance of microbes to extreme environments and a possibility of their transfer beyond geographical barriers of Earth on external spacecraft surfaces have brought forward a need in profound research into the likelihood of their survival in outer space.

Hardware and a program have been developed at the State Scientific Research Center of the Russian Federation – Institute for Biomedical Problems with the goal of carrying out a space experiment “Biorisk”. The experiment was aimed at assessing the possibility of long-term, comparable with the duration of the Martian flight, survival of microorganisms in outer space on materials used in space industry.

Samples of materials were contaminated with test cultures of bacteria (*Bacillus*) and fungi (*Aspergillus*, *Penicillium*, *Cladosporium*) known to be common residents of various environments on Earth and resistant to multiple alternation of high and low temperatures. Materials used in the construction of external spacecraft surfaces such as steel, aluminium alloy, heat-insulating coating were chosen as test samples for the experiment.

Containers with materials and test microorganisms were placed on the external side of the Russian segment of the ISS.

Unique data have been accumulated after a 204 day exposure on the external side of the ISS, which have proved that representatives of bacteria and fungi possess a potential for long-term survival under the conditions of outer space.

Extreme environment of outer space has shown to have practically no influence on the survivability of bacterial spores. Although fungal spores demonstrated lower resistance to the said environment they were also recovered from the samples of materials after their exposure to space. Moreover, test microorganisms have preserved high bioactivity.

Thus, the fact of long-term survival of terrestrial microorganisms in the outer space environment have been established for the first time, which suggests the existing possibility of interplanetary transfer of microorganisms on external spacecraft surfaces.