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BIOPRINTING AS A FUNDAMENTAL TECHNOLOGY FOR MEDICAL TREATMENTS WITHIN EXPLORATION MISSIONS AND HUMAN SPACEFLIGHT

Abstract

Within the context of human exploratory missions to the Moon or Mars as the next logical steps in human space exploration, main constraints are the long term exposure of humans in space and (in case of increasing distances to Earth) no abort possibilities. As a consequence, crews on such missions have to be self-sustaining also with respect to medical treatment. In addition to health risks of illness or injury human beings are faced on Earth, additional ones are raised by the environmental conditions in space - such as the influence of altered gravity, radiation and isolation.

Due to the fact, that in case of long distance travels the medical infrastructure on Earth is not reachable in a reasonable amount of time for medical care, such space exploration missions have to consider a medical infrastructure onboard for a wide range of health issues to protect human lives and health.

The implementation of 3D-bioprinting to enable long duration missions, far away from our home planet, is a promising approach, which was evaluated within the PLT-Space project (**P**rinting of **L**iving **T**issues for **Space** Exploration), initiated and funded by the European Space Agency, ESA.

The potential of bioprinting to provide support in medical treatment and improving the autonomous functionality of the medical structure in exploration missions and human spaceflight was investigated based on different illnesses and injuries e.g. regarding skin, bones, cartilage and in the future organ-parts, heart, dental elements and nerves. Within this context, different medical procedures and the corresponding relevance of bioprinting were described for 3 different medical scenarios (full treatment in space with surgery/ first aid on site and return to Earth for further treatment/ no surgery in space). The different printing technologies have been evaluated as to space-adaptability and also infrastructure-requirements (based on scenarios for missions close to Earth as well as ones more distant from earth – with different duration). Finally, a roadmap for the next steps was developed and a space relevant exemplary

sample was printed. Main findings of the project concerning these described tasks will be presented at the assembly.