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Medical Care for Humans in Space (3)

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END-TO-END REMOTE AND TELE-MEDICINE

Abstract

Long distance and long duration human space flights are getting more and more realistic. In near future, a Deep Space Gateway and the Moon will become a new domicile for humans. Deep space missions will follow. Management of resources will determine the complexity and duration of missions. If we compare actual missions with future long duration or long distance missions, more and more of the off nominal scenarios will become nominal cases. Injuries or illnesses should be handled as facts in the mission planning. Hence, we have to prepare ourselves for good analysis methods to detect any "off-nominal" behavior of the human health status as well as of the environment. Only based on good and easy to use analysis methods (relying on minimum resources), countermeasures can be identified at an early stage which will immediately lower the risk of negatively influencing mission success. E-Nose, Immunolab and CIMON are representing three state of the art facilities for such analyses. They provide the feature of data transfer to specialists on ground as well as the interpretation of the provided data by the crew members themselves or even via artificial intelligence. While having E-Nose already operational, the flight model of Immunolab is ready for integration and flight acceptance. Thus, it will be used on-board the ISS soon. CIMON will be commissioned during summer 2018. It is assumed that with those facilities in place, the health status and the environmental quality can and will be analyzed with a minimum of resources, near real-time. Several studies for countermeasures have been successfully accomplished. There are still many ongoing and most likely many to be planned as well. The current situation already outlines a good choice of available countermeasures. Besides the obvious medications according to the diagnosis, physiological countermeasures like artificial gravity by a Short Arm Human Centrifuge or even organ replacement via Tissue Printing becomes more and more realistic.

The end-to-end scenario from detection to countermeasure until validation of success by additional analysis shall be put into focus for human space flights. The paper presents the current roadmap of the described end-to-end scenario.