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MDRS CREW 206'S SLEEP ANALYSIS WITH DREEM: INFLUENCE OF THE MISSION AND THE EVAS ON SLEEP QUALITY

Abstract

Onboard the ISS, the mission's duration is increasing, to prepare the future explorations of the Moon and Mars. One of the challenges of long space flights is to understand the behavior of the human body in space. The astronauts' biological activity can be modified during the flight and needs to be studied, such as sleep since it can be unpredictable and even jeopardize a whole mission. Since Skylab and Mir missions, it has been reported that the sleep quality of the crew was seriously impacted [1]. From February 24th to March 17th, six students from ISAE-SUPAERO took part in a Mars analog mission at the Mars Desert Research Station (MDRS 206) in Utah. For five years, crews of students from ISAE-SUPAERO take part in such missions to deploy experiments in a Mars-like environment, to prepare future exploration missions to the Moon and Mars. One of the experiments lead during this mission was a sleep monitoring of the crew, by using a tool developed by the startup DREEM. The DREEM headband measures and analyzes the sleep of its users. To understand the sleep, it measures key biological signals: brain activity, heart rate, respiration rate, and movements, with EEG sensors, pulse oximeter, and accelerometers [2]. All these raw data are then analyzed with machine-learning algorithms, to provide an analysis of the sleep, giving information about one's sleep, such as the time to sleep, the sleep phases, duration, or agitation. During the mission MDRS 206, daily EVAs (Extra-Vehicular Activities) were conducted, where three or four crew members went out of the station, to deploy scientific experiments, or to explore the area around the station. The EVAs were performed in the morning, could last three hours, and were quite exhausting due to the spacesuits and the equipment. The EVAs were scheduled, and there was a rotation of crew members on EVAs. This paper sheds the light on the influence of the EVAs and the MDRS 206 mission on the sleep of the crew. It raises the fact that the crew faced an important modification of its sleep during the mission compared to the pre-mission and the post-mission, due to the new environment it had to cope with, and the strict schedule that was imposed. The sleep duration decreased during the mission, and much more during the second and third week: crew members lost an average of 55 minutes of sleep between these two weeks. Moreover, having an EVA or not seems to influence key data of the following night, as the time to sleep, or the sleep phases. On days with EVA, the time to sleep was reduced on average by 20The data will be combined with other human factors experiments of the mission (TELEOP rover driving experiment, and virtual reality experiment) to study the correlation between these experiments and the sleep of the crew. Finally, in 2020, fourteen students from ISAE-SUPAERO will be part of a MDRS mission. Continuing the sleep monitoring of the crews (two crews of seven next year) might enable us to gather enough data to draw more precise conclusions.