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Assessing group dynamics by individual radio satellites in the Mars-500 project

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Group structure and group cohesion and their changes over time play an important role for the success auf long-term missions with high degree of autonomy in confined isolation environments (ICE). In a methodological feasibility experiment a wireless group structure (WLGS) monitor system was developed and tested during the Mars500 project. Twice a week each crew member brought a small short-distance radio satellite registering the presence of any other sensor in-room in five second intervals during the wake time. Six satellites were additionally attached to the wall of the simulator's main compartments. The time being together was registered as well as the signal amplitude providing an estimate of the distance between two satellites. An actigraph sensor permitted the evaluation of the bringing regime. Technical troubleshooting was not at all available during the 105-day study and limited during the 520-day study. First analyses of the 520-day study are presented here. In 29% of the measurements one satellite, in 7% 2 satellites of twelve were not working properly. Due to insufficient battery charge only 86% of the measurements run over 8 hours. However, the internal correlations of each possible satellite pair were all highly significant. Permitted by the crew the registered data could be exemplarily compared for day 475 with the video recordings of the safety cameras. The accuracy of registration was about 95% during a 10 hour period.

For each of the remaining 86 measurement days an integrated score, the "crew cohesion time" (CCT) and individual behavior patterns were determined and analyzed over time. The time structure within the crew occurred to be stable during the 105-day study as well as during the 520-day study. The CCT fluctuated across the studies. A cross-correlation with the data of a standard sociometric questionnaire of the IBMP provided significant correspondence of both methods for the 105-day

study. During the 520-day study these correlations increased in a rhythmic way towards the end of the study.

Summarizing, the innovative new WLGS method was first time tested during the Mars-500 project. Several comments of the crew will be used to improve the robustness and applicability of the system. The first validation analyses suggest that the system could become a useful tool to monitor changes in the group structure of small teams under ICE conditions.

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