

SPACE LIFE SCIENCES SYMPOSIUM (A1)  
Behaviour, Performance and Psychosocial Issues in Space (1)

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THE MARS500-EXPERIMENT “6DF” – A TEACHING AND TESTING APPROACH – FIRST  
RESULTS

**Abstract**

Introduction Manual control of moving objects in weightlessness requires the operator to consider six degrees of freedom (6df) of movement simultaneously. This paper presents the current state of a project aiming at the development and evaluation of a self-sufficient psycho-diagnostic training tool which combines practical needs (training, education of important operational skills required during space flight, e.g. for manual spacecraft docking) with excellent scientific research opportunities (embedded testing e.g. of memory, cognition, complex coordination or dyadic/group structure) while providing a high motivational affinity for the subjects. As an ESA supported project the first implementation of this tool was tested during the 105-day pre-study of the Mars500-project (Moscow, IMBP). The results will be presented here. Method Three of the 6 subjects who participated in the isolation study were untrained in docking maneuvers. Prior to the study they were only instructed on how to handle the soft- and hardware of the training device. During the isolation a training session was run every 2 to 3 weeks. Instructions were displayed on the screen and in a textbook. The sessions differed with respect to the sequence and the level of difficulty of the tasks. The subjects were instructed to repeat a respective session on their own discretion. The visual effects on the screen were the only feedback to the subjects. A pathway of ellipsoids guiding the spacecraft from its own position to the docking terminal of the station was displayed to prevent the spacecraft from deviating too far outside the approach sector. As a measure of individual training success a final application of the Russian standard trainer for spacecraft docking was used in the last session of the isolation period and in the post-isolation session. Results Two of the three subjects performed successfully in manual controlling the simulated docking of a Soyuz spacecraft on the ISS. The third participant failed due to excessive docking speed, but he met the other coordination criteria. Interestingly, the three participants in the 6df-training experiment demonstrated comparable performance scores compared to the other three participants who had successfully completed training prior to the study. However, the low statistical power did not allow statistical significance testing. Conclusions Even in a prototype version the visual feedback based training tool 6df provided promising results. Therefore, the 6df-experiment was accepted for the 520-days phase of the Mars500-project. A further development of the 6df is granted now by the DLR Space Agency.