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HIGH VERSUS LOW CREWMEMBER AUTONOMY IN SPACE SIMULATION ENVIRONMENTS

Abstract

BACKGROUND. Due to the long distances involved and the kinds of activities planned, crewmembers involved with lunar and Martian expeditions will have more autonomy than in previous space missions. METHODS. In order to study the impact of high versus low work autonomy on crewmembers and the crew-mission control interaction, we have conducted a series of pilot studies involving three space simulation environments on Earth: 1) NEEMO missions, where crewmembers live and work in the Aquarius submersible facility off the coast of Florida; 2) the Haughton-Mars Project (HMP), where crewmembers conduct activities under Mars-like simulation conditions on Devon Island in Canada; and 3) the pilot phase of the Mars 500 project, where a crew simulates an expedition to Mars for 105 days in an isolation facility located in Moscow. As in our previous on-orbit studies on the Mir and ISS space stations, crew and mission control subjects working in missions involving these three space analog environments completed a weekly study questionnaire that included mood and interpersonal interactions questions from the Profile of Mood States, the Group Environment Scale, and the Work Environment Scale, as well as a log of critical incidents. The Mars 500 pilot study also included questions that we developed which assessed individual and group autonomy, work efficiency, and work accuracy. In these studies, high autonomy periods were those where crewmembers planned much of their work schedule, whereas low autonomy periods were those where mission control personnel developed the schedule, much as happens now during actual space flight conditions. RESULTS. Preliminary results have suggested that high work autonomy was well-received by the crews, that there were no adverse effects, that the involvement of the crew leader increased and that of the mission control team decreased, and that there was increased cohesion in the high autonomy conditions of the Haughton-Mars Project. More specific results will be reported as we expand our analyses. CONCLUSIONS. Increased crew autonomy under space analog conditions on Earth appears to be feasible and safe and suggests several advantages in terms of mood and crew interactions. It is time to examine the effects of high autonomy in space during on-orbit missions in order to prepare for future expeditionary missions to the Moon and Mars.