

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

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HABITABILITY OF MANNED VEHICLES: THE IMPACT OF HUMAN FACTORS ON FUTURE
LONG DURATION HUMAN SPACE EXPLORATION MISSIONS EN ROUTE TO MARS

Abstract

Placing humans in space for a long duration mission beyond Earth's neighborhood implies the design of a highly complex system to travel, live and work safely in the hostile environment of deep space. In order to identify all the constraints from both engineering and human sides, a meticulous system engineering approach has to be followed and the human sciences, including incorporation of ideas from artists, ergonomists and psychologists, have to be integrated in the very early stages of the mission design. Given the future human spaceflight destinations en route to Mars, i.e. deep space-habitats at Earth-Moon Lagrange points, lunar bases and asteroids, the main psychosocial and psychological issues are concerning the adverse effects of prolonged co-living and co-working in small groups, under conditions of confinement and isolation. With the aim to study the impact on habitability of latent and overt stressors, yielded by space flight missions, and to gain a deeper understanding of crew productivity and reliability, in socially risky situations and extreme environments, we conducted a survey involving a large sample size of participants, especially from naturalistic space analogues (*Concordia station, COMEX SA EVA tests in the Bay of Marseilles, polar expeditions, remote sea-based oil drilling platforms, caves, aircraft cockpit simulators...*) The participants completed a questionnaire aiming to examine the effects of psychological, interpersonal and environmental factors on individual well-being and team performance. The data collected revealed the potential risk for every space analogue and helped to quantify the general statement which claims that no place on Earth can reproduce the exact extreme space conditions. The results suggest that the design of habitats and habitable structures for spaceships, extra-terrestrial planetary surfaces and analogue environments should include as many private crew areas as possible. The implementation of a continuous "in-flight" psychological support from the ground also appears to be a primary need. In addition, job specifications should be more team-work oriented, in order to avoid creating unwanted moments of isolation. Several other countermeasures are proposed for a successful integration of the human factors subsystem in the early mission planning. Finally, the paper discusses a spin-off for terrestrial applications: our study found a strong synergy with the automation of dependent people with reduced mobility.