

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

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TEAM PERFORMANCE IN SPACE CREWS: HOUSTON, WE HAVE A TEAMWORK PROBLEM

Abstract

Space crews venturing beyond low Earth orbit will experience unprecedented levels of autonomy and a multitude of unpredictable challenges. Effective team performance will be critical to mission success. To better understand crew performance capabilities, we examined three dimensions of crew performance (creative thinking, problem solving, and ethical decision making) over time during a total of 4, 30 day analog space missions conducted in NASA's Human Exploration Research Analog (HERA). Crews of 4 participants endured isolation, confinement, and communication delays, like those to be encountered in future space exploration.

We examined three dimensions of team performance capturing task domains on which an effective astronaut crew must perform: generate, choose, and negotiate. "Generate" processes are tasks that create ideas or plans. "Choose" processes are tasks that involve making a choice and include decision making or intellectual tasks with a "correct" answer. "Negotiate" processes are tasks that involve resolving conflict and include cognitive conflict tasks and mixed-motive tasks. We administered parallel versions of each of the three team tasks on Mission Days 11, 16, and 30.

Results indicated that crew performance declined over time overall; however, nuanced effects were observed by performance dimension. All 4 crews showed declining levels of problem solving and creative thinking. While performance changes over time were not observed for ethical decision making, there was significant between-crew variation in the quality of their ethical decision making. Because there are meaningful differences over time for both creative thinking and problem solving performance scores, these dimensions may benefit from mission interventions designed to counter performance decrements. Because we observed between crew differences in ethical decision making performance, this dimension may be addressable via crew composition or pre-launch training.

Whereas many aspects of astronaut selection and training focus on highly behavioral coordinative tasks in the "execute" domain, we observe decrements in the more interpersonally and knowledge-intensive domains of creative thinking, problem solving, and ethical decision making. These dimensions are likely to be critical as astronauts on future space missions becomes more reliant on one another to solve the inevitable unanticipated challenges and opportunities of exploring deep space.