

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

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IMPROVING CREW SUPPORT METHODS IN HUMAN-MACHINE TEAMS FOR LONG-DURATION
MISSIONS

Abstract

Long-duration missions (e.g. to the Moon, asteroids, or Mars) require astronauts to collaborate and interact with complex computerized equipment and facilities under dynamic and hazardous conditions. The Mission Execution Crew Assistant (MECA) comprises crew support that acts in this ubiquitous computing environment as an "electronic partner" (ePartner), helping the crew to take care of their mental and social conditions, to train and schedule tasks during (off-)nominal situations, to enhance shared situation awareness, sense making, and problem solving processes during operations.

We evaluated MECA's crew support methods during the MARS-520 experiment (520 days). MARS-500 provided a unique test platform, because of its setting, where a small crew is isolated for a long duration simulating a manned Mars mission. Thus more prolonged or repeated usage of MECA could be tested. The evaluation focused on core support functions that concern prolonged or repeated usage of MECA.

For the MECA experiment, two groups of three astronauts trained and gamed every other week for thirty minutes (including procedure training and entertainment gaming). The astronauts communicated via chat. MECA collected information on crew condition (social network, emotional state) and performance (effectiveness and efficiency of operations during training and gaming), and provided (simple) feedback on crew condition and performance. Research questions were, how to:

- record and interpret social, cognitive and affective processes during computer based tasks.
- provide individual and team feedback on these processes.
- the crew responds to such ePartner actions.

The Mars500 support functions were perceived useful in general, but major improvements in the content, personalization, usability and attractiveness proved to be needed to establish high performance profits and end-user acceptance. For better effects on performance, user modeling methods should be applied to tailor the support functions to the individual situated support needs. Providing a tool that can be used freely (like chat) seemed to have large opportunities to collect data on emotional states and group cohesion.

Important lessons learned were: richer content and interactions are needed for long duration, empirical studies of this kind. Lack of a common language brings additional constraints and costs. Constraining

or stripping game functionality to control user behavior had a negative effect on user motivation. The prototype and test set-up should induce an adequate level of intrinsic motivation. The crew-members liked to have timeline support. Large size and diversity of data; proving to have much potential to monitor and interpret crew(-member) conditions, performances and perceptions.