Half-time for the Mars500 mission

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Mars spacesuit testing. Credit: ESA

The Mars500 mission – a simulated mission to the red planet in which researchers from the Mainz University Medical Center in Germany are involved – has reached its half-way mark: After a 250-day virtual flight, the crew members recently landed on the virtual red planet and left the isolation container at the Moscow Institute of Biomedical Problems (IBMP) in their space suits. Researchers from the Medical Center of Johannes Gutenberg University Mainz have been involved in the Mars500 mission in an attempt to answer the question of how medical emergencies might be managed without external assistance. The group of researchers led by Professor Wolf Mann, M.D., Director of the Department of Otolaryngology, Head, and Neck Surgery - Plastic Surgery, and Professor Christian Werner, M.D., Director of the Department of Anesthesiology, has drawn positive interim results on the occasion of this virtual landing on Mars: The researchers assume that

medical emergencies on a future trip to Mars could be mastered by providing crew members with targeted training.

The European Space Agency (ESA) and the Russian Institute of Biomedical Problems (IBMP) arranged the Mars500 mission to clarify whether man's physical and psychological health can be guaranteed under the extreme conditions posed by a flight to Mars. For this purpose, the crew members are set various tasks and asked to conduct a number of experiments. One aspect to be looked at is the problem of how to manage medical emergencies without outside help. Solutions and a relevant concept have been developed by experts of the University Medical Center of Johannes Gutenberg University Mainz, Germany – and this is now being successfully applied. Financial support for the project to the amount of € 257,000 is being provided by the German Aerospace Center (DLR).

"Around 250 days for the outward trip, 30 days sojourn on the surface of the planet Mars, and 240 days for the return flight - experts assume that a long-term mission to Mars will probably take all of 520 days. The crew will be exposed to extreme physical and psychological stresses during this period. Six persons will need to be prepared to co-exist in extremely cramped confines and conditions for nearly 18 months. Food will be rationed, and illnesses and injuries will need to be treated by the team members themselves. Only little help from Earth is to be expected when it comes to providing emergency aid to sick or injured colleagues as there will be major delays of up to 20 minutes in communication each way," explains Professor Wolf Mann, M.D., head of the Mars500 project team at Mainz University Medical Center.

"This means that the crew will have to learn to be fully self-sufficient, particularly in view of the fact that absolutely anything can happen. They may even have to be capable of resuscitating a crew member if the worst comes to the worst. The astronauts will require a form of medical

training specially adapted to the needs of long-term missions if they are to survive," adds Professor Christian Werner, M.D., Director of the Department of Anesthesiology.

The experts based at Mainz University Medical Center thus developed a training concept for the IBMP / ESA simulation research project that can be used to provide non-professionals with the knowledge and skills needed to master emergency medical situations. Before the future test astronauts moved into their shared "Mars residence," the Mainz team provided them with initial training on-site in a three-day course in Moscow. "This practical training focused on mastering medical treatment procedures that have been specially modified for use under zero gravity conditions, for example the procedure to follow in the event of heart failure," explains Dr Julian Graf, medical assistant at the Clinic of Anesthesiology, who was in Moscow for the occasion. "The crew mastered our medical emergency training course with very good results. All participants were extremely motivated."

The training concept used is based on the results of a pilot study involving medical students at Mainz, and the data gathered by Professor Mann and Professor Werner and their team during a study of the crew working at the Concordia station at the South Pole.

To ensure that the participants retain the imparted knowledge and skills in the long term, the team of trainers from the Department of Anesthesiology and the Department of Otolaryngology, Head, and Neck Surgery is concentrating on the trainees' exercise of the procedures learned in theory. During the 250-day virtual outbound flight, the crew had to cope with several emergency scenarios. The aim was to play out these scenarios using the simulation doll. The crew's theoretical knowledge was tested with the aid of multiple-choice questionnaires. "Overall, the emergency medical supply and treatment of the simulation doll went well on most occasions, and the crew members successfully

solved all emergency scenarios," Professor Mann concludes with a positive note. "A positive treatment result is thus also very probable for a real patient." The next step will now be to offer refresher courses to some of the crew members, and then to find out how the participants do overall and how much knowledge is lost with and without having had a refresher course.

Further information on Mars500

Mars is some 50,000,000 kilometers from Earth and experts believe that it will only be in several decades' time that the human race will actually travel there. Despite this, the European Space Agency (ESA) and the Russian Institute of Biomedical Problems (IBMP) have already begun putting in place detailed preparations for this new challenge to manned spaceflight and simulating a flight to Mars. This isolation study, known as "Mars500," investigates the participants' stamina over a period of 520 days. The "Mars500" crew consists of six participants - two from Europe, three from Russia, one Chinese. The standards that these volunteers have to meet are roughly the same as those that the IBMP and the ESA would require of astronauts participating in a genuine Mars mission.

The isolation study is conducted in a specially designed Mars500 container located in the Institute of Biomedical Problems in Moscow. This is a tubular module system with a living and working area of 180 square meters. There are also cold storage facilities for the food and a quarantine unit. Each of the test astronauts is provided with a personal cabin with a floor space of three square meters including a small bed.

A manned mission to Mars not only represents a massive technological challenge, but would also subject the astronauts involved to extensive stresses: The crew would need to be able to coexist amicably for some 18 months in the tiny space available and work together to resolve any

problems that arise. The IBMP and the ESA also analyze these interpersonal factors in greater detail during the simulated mission to Mars. The crew is expected to carry out a wide range of experiments, and they are confronted with "unexpected problems" in their containerized world that the external project supervisors contrive to them. They also have to cope with delays of up to 40 minutes in communications with "mission control."

Provided by Johannes Gutenberg University Mainz