



News

## Mission to Mars – in Moscow sandpit

**Six 'astronauts' test human endurance in outer space and explore imitation planet surface in spacesuits**

Friday, 11 February 2011

TAGS: **INTERNATIONAL NEWS**

After a gruelling eight-month mission without sun or fresh water, man will descend on to the surface of Mars, in what might be described as one giant leap for the imagination.

Three members of the European Space Agency's six-man multinational crew, Alexander Smoleevskiy, Diego Urbina and Wang Yue, will climb out of their mocked-up spaceship into an engine-less descent module, and shortly afterward simulate touchdown on the red planet – in reality, a giant sandpit inside a large hangar in Moscow's Institute of Biomedical Problems.

On Monday the trio will then don spacesuits and venture through an airlock and on to the surface, which is strewn with boulders to mimic walking on the Martian surface.

The gravity on Mars is roughly one third of that on Earth, so the crew will use lighter spacesuits than normal. Once out on the mock Martian surface, they will use drills and geological tools to perform experiments on soil and rock samples. After 30 days working on the surface – a stint that involves a virtual drive in a Mars buggy – the crew will then face a 240-day "return trip" to Earth.

ESA's Mars500 experiment is designed to explore how humans cope with the stress, isolation and limited company that future astronauts will face on missions to the outer reaches of the solar system.

Over the course of the mission the crew – made up of three Russians, two Europeans and one Chinese – will spend a total of 520 days inside this handful of interconnected modules, the largest of which is the size of a bendy bus.

Their schedule is filled with a daily list of mission tasks, exercises and experiments designed to monitor how their bodies and minds are coping with their environment.

The men, who were chosen from thousands of highly qualified applicants, "blasted off" in June last year and will not complete their mission until November.

One of the crew, the Russian cosmonaut Alexey Sitev, married shortly before embarking on the mission.

"In general the crew is doing great, surprisingly great I would say. They have been in there a long time," said Christer Fuglesang, a Swedish physicist, veteran of two shuttle missions to the International Space Station and head of the \$10m Mars500 project.

"At the beginning it is new and exciting, but eventually not so much new happens and you get bored and your mood can decrease. We have seen that a little bit, but not severely for sure. We've not had any fights yet," Fuglesang said. ESA officials are to meet with scientists in April to review what the mission has revealed.

Mission controllers at ESA watch the crew through CCTV cameras to see how the group dynamics vary in different scenarios. Without warning last month, they cut power to the modules and pumped in smoke to simulate a major electrical failure.

"They dealt with it very well, but what was interesting was they actually thought it was real. When everything was working again and they were told it was a simulation, they refused to believe it for a while," said Fuglesang.

The simulated space mission put the crew's capsule in orbit around Mars earlier this month, where they practised docking with a supply ship carrying food, water and other necessities for the landing and return trip to Earth.

In an exchange of tweets with the Guardian before landing, Urbina, a 28-year-old Italian-Colombian engineer, said: "The toughest part I guess is the cruise phase, because of the monotony. The landing phase has been challenging but fantastic because of the fast pace."

In their spare time the crew do their best to keep boredom at bay with books, DVDs and video games like Guitar Hero. A few months ago the French crew member, Romain Charles, gave juggling lessons with a set of balls improvised from linseed and balloons.

The crew took food rations for the outward leg of the mission but have a small greenhouse in one of the modules to provide meagre helpings of fresh fruit and vegetables, including tomatoes, radishes and strawberries. They "jettison" their waste by putting it in an airlock, where it is collected and disposed of by ESA staff.

While the mission cannot simulate the weightless conditions of space travel, the crew face a realistic hardship in communicating with Earth, with 20 minute delays added to messages each way. The crew can talk to friends and family only by email, twitter and recorded video messages.

Humans have not left Earth orbit since the end of the Apollo missions in 1972 and there is no prospect of a genuine mission to Mars on the horizon. The technical hurdles of building a rocket capable of reaching Mars while protecting its crew from the intense radiation of space are enormous.

"I think what we really need is a new kind of engine that can take us to Mars not in eight months, but in two months, and it will probably be another 20 years before we even get close to doing this," said Fuglesang.

Nick Kanas's expert view Lack of danger limits learning

With a simulation like this, you can test the impact of isolation and confinement on people for a long period of time in a relatively inexpensive way. It's a lot cheaper than flying people in space – and much safer too.

If you want to change procedures that aren't working, you can do it without worrying about the dangers of being in space. If someone falls ill or wants to stop, you can and let them out. Finally, there are a lot of factors affecting behavior in space, and in a simulation you can control some of these variables in order to understand which factors are scientifically most important.

But there are downsides. You can't simulate a real danger. Crews in space are always thinking about a meteor breaking through, or a problem with their life support system. And you can't simulate microgravity for long periods, so whatever impact it has on your brain and what that might do to your emotional and psychological state, you don't really know. It is hard to simulate being in a real spacesuit, with no oxygen outside, in the low gravity and high radiation environment of Mars.

On a real Mars mission, it would also be the first time that humans are neither on the Earth nor able to see the Earth as a sphere in space. What they're going to see is a tiny, pale dot. Our studies show seeing the Earth and appreciating its beauty is very important for the wellbeing of astronauts. They get a great pleasure out of that. What the impact will be of seeing the Earth as an insignificant blue dot is unclear. It may not be anything, but we don't know that.

Going to Mars, all bets are off. Suddenly you've got a 30- to 40-minute delay in communications, and you can't send up surprise presents because they're too far away. Astronauts really are isolated. Whether we will see demoralisation and the blues after several months on a Mars trip remains to be seen.

One kind of simulation that would be more realistic is to simulate the outbound and return trip to Mars using the International Space Station and the partial gravity conditions on the red planet by having a crew doing Mars-like activities on the Moon. Such an ISS/lunar simulation would probably be shorter than a real Mars expedition, but many of the danger and microgravity elements would be present.

Dr Nick Kanas at the University of California, San Francisco, has worked with Nasa on astronaut psychology for more than a decade